

CHAPTER VII.—STONE CONSTRUCTION IN CITIES.

AKRON, OHIO.

Akron has ready access to the celebrated quarries at Amherst, Berea, and other localities. The greater part of its stone construction is of the sandstone quarried from local quarries, while Berea sandstone is also largely used; for foundations and underpinnings the local sandstone is exclusively used. The Akron sandstone, when carefully bedded, makes a very durable building stone, but its strength is not very great when the pressure comes unequally upon it. Memorial Chapel building is of sandstone from Marietta, Ohio. Stone has been but little used in paving the streets, and sandstone from Medina, New York, is the material used for this purpose. The sidewalks are largely paved with Berea sandstone.

ALBANY, NEW YORK.

Stone fronts in Albany are mostly of Connecticut brownstone. Ohio sandstone is used in trimmings. Granite from Maine has been used in some of the finer structures, such as the state capital, city hall, United States court and post-office buildings, and the state hall. Among the buildings in which Connecticut brownstone has been used are the Albany academy, cathedral of the Immaculate Conception, Saint John's Roman Catholic church, Saint Peter's church, Second Presbyterian church, Protestant Episcopal church, and Emanuel Baptist church. As in all the towns and cities on the Hudson, Albany is largely of brick; stone is used for large public edifices and in dwelling-house fronts to a limited extent. The cheapness of brick enables them to compete successfully with stone, even in foundations and cellar walls. A great variety of stone has been used in the new capitol building; the mass is Maine granite. In the interior decorations Mexican marble, Bellville sandstone, Ohio sandstone, and Lake Champlain marbles have been used.

Saint Joseph's Roman Catholic church is trimmed with Caen stone; this material weathers badly, and does not stand the severe winters. The Episcopal church, State street, is trimmed with Hudson River sandstone from Schenectady. This material comes out with natural faces, and these are weathered to brownish and greenish-yellow shades of color, giving the front a highly-variegated aspect. The weathering or fading on exposure is seen in different shades of color between the stone of the building proper and the tower; the latter, of later construction, is the darker shade. The Second Reformed church, a large edifice of a composite style of architecture, is of limestone of Trenton age. The foundations and underpinnings are built of limestone from Amsterdam, Howe's cave, Kingston, and Glens Falls; also sandstone from Schenectady, Highland, and other places in Ulster county is used for this purpose. The streets are largely paved with stone, and the materials used are boulder or cobble-stone and granite blocks from New England; the dimensions of these blocks are usually about 14 by 4 by 8 inches. The following is an approximate statement of the number of miles of pavement of the different materials: 38½ miles of cobble-stone pavements, 4 of granite block pavements, and 1½ of macadamized pavements; total number of miles, 43½. Number of miles of unpaved streets, 89½.

The sidewalks are largely paved with stone, and the materials used for this purpose are the Hudson River blue flag-stone, and blue flags from the Helderberg mountain; also some Potsdam sandstone; the curbstones are of the same materials.

ALLEGHENY, PENNSYLVANIA.

What is true of stone construction in Pittsburgh is also true of it in Allegheny, as the two places are separated only by the Allegheny river, and the sources of their building materials are precisely the same. In rare instances Connecticut brownstone is used, and a very little of New England granite, principally for cemetery work, but nearly all the stone construction is of sandstones and limestones of sub-Carboniferous and Carboniferous age quarried west of the Alleghany mountains, in Pennsylvania and Ohio.

ALLENTOWN, PENNSYLVANIA.

The stone used for foundations and other ordinary purposes of construction in Allentown are limestones and hard sandstones from small quarries in the mountains near the city. Sewers are constructed entirely of brick. The building stone used here is limestone and the mountain sandstone, and is of the most durable quality. The city engineer reports that the ground in some portions of the town is unfavorable to heavy buildings on account of being cavernous. The bridge abutments and arches are built of limestone and quartzite from the mountains near the city. The streets are but little paved with stone, and the material used is cobble-stone from the river. Some

of the streets are macadamized with limestone from the vicinity. There is but little stone sidewalk paving, and the material is the North River and Wyoming blue-stones, but the native limestone from the Lehigh valley is used to some extent for this purpose.

ALTOONA, PENNSYLVANIA.

The sides of the mountains near Altoona are thickly strewn with surface rocks of different geological formations which furnish nearly all the building stone for cellars, foundations, terrace walls, and other ordinary building purposes in the town and vicinity. These surface rocks are durable and very hard from long exposure to the weather. On breaking them up numerous cracks are found, owing probably to the effects of the frequent fires that pass over the mountains. The material is so rough and hard as to make it extremely difficult to dress, and it is therefore not found practicable to use it for any other than the ruder purposes of construction, where dressing is not required. Material from a quarry of what is probably sandstone of Pocono (sub-Carboniferous) age, 2 miles from Altoona, is being introduced to a limited extent for cellar work and foundations. It breaks irregularly and with a conchoidal fracture. The supply of the material which is available is not large, owing to the amount of dip (about 45°) into the hill. For finer cut work some sandstone from Gallitzin, on the Pennsylvania railroad, west of Altoona, and in Cambria county, is used. It has a local use for caps, sills, bases, etc., as far east on the Pennsylvania railroad as Huntingdon, a distance of 60 miles. Amherst and other northern Ohio sandstones are employed to a limited extent for trimmings. The stone work in Altoona is confined chiefly to cellar and foundation work and a few terrace walls, the ground on which the city is built being somewhat uneven. There is scarcely any stone work in the shape of caps, sills, and columns, brick being used, as there is no stone in the immediate vicinity which would be very suitable for these purposes. The streets are paved with cobble-stones from the streams in the vicinity, but there is very little stone sidewalk paving. In front of the Logan house there was formerly considerable pavement, constructed of hard blue slate, which has a smooth, even surface, and presents a pleasing appearance when first put down, but is not durable.

ATLANTA, GEORGIA.

The stone chiefly used in this city is from local quarries. Some is brought from Dixon, Alabama, and Bowling Green, Kentucky, for trimmings. The Stone Mountain granite is shipped west to be dressed, polished, and carved, and then returned. The only buildings constructed entirely of stone are the warehouses. The usual style of building is a foundation and superstructure of brick with stone trimmings. The United States post-office and court-house is built of granite from Vermont. The foundation is the Stone Mountain granite. The new county court-house is to be trimmed with Bowling Green limestone. Several stores are trimmed with Dixon, Alabama, stone. The brick is of very superior quality; stucco is used to some extent; the use of stone is increasing. The city has 133 miles of streets; of these 10 miles are macadamized, and only 7 miles have brick and stone sidewalks; 11 miles of the streets are sewered, and of the sewers about one-third are constructed of stone. The city prisoners work the quarry, and they are employed a portion of the time in macadamizing the streets and roadways.

The city of Atlanta has an abundant supply of rock and good granite accessible. The soil is red clay and furnishes secure foundations. The most durable stone is gneiss, locally called "blue granite". The Stone Mountain granite wears away under attrition, and has not been long enough in use to determine its wearing qualities. The best granite at present known in the state is in Oglethorpe county, but it has not been used much as yet; it resembles very much the Quincy granite of Massachusetts. The growth of Atlanta has been very rapid of late years, and the macadamizing of the streets has proceeded at an average rate of only one mile a year. Granite, chiefly from Lynch's city quarry, is used by the railroads for bridge piers and retaining-walls; the railroad cut in the city is braced in this way.

BALTIMORE, MARYLAND.

The rocks exposed in the immediate vicinity of Baltimore are gneiss of Archæan age, and it was this material that was first drawn upon for the ordinary purposes of stone construction, it being the most convenient. Baltimore has, since its foundation, had ready access to all the important quarries on the eastern sea-coast, and it has drawn largely from this source. There is much of the Connecticut and New Jersey sandstone used; and of late years granite from the quarries on the coast of Maine has been largely employed. In the early times of the city, stone brought as ballast in the numerous ships arriving was used for ordinary purposes. Another important source of supply in later years and at the present time is the marble quarries at Cockeysville, a short distance north of the city. Granite from various points in the state of Maryland has been largely used, especially that quarried at Ellicott City, on the Patapsco river; at Woodstock, in Howard county, and at Jones' falls. Since the city has had railway communication with all points in the interior, serpentine from Chester county, Pennsylvania, and Ohio sandstone have been largely used.

The following are some of the most important stone structures in the city: The Eutaw Place Baptist church, which has a tower 187 feet in height; the Brown Memorial Presbyterian church, corner of Park and Townsend streets;

the Franklin Street Presbyterian church; the city hall, and the Peabody Institute. These are all built of marble chiefly from the Texas and Cockeysville quarries, north of Baltimore. The Peabody Institute exhibits the Maryland marble to good advantage, as care was taken in selecting the material. In several buildings a very few defective stones injure the effect of whole structures. The First Presbyterian church, corner of Madison and Park streets, is built of New Brunswick, New Jersey, sandstone. The city prison is built of gneiss from Jones' falls, with marble trimmings. The Catholic cathedral is built of gneiss from Ellicott City; the foundation-stone of the building was laid on July 6, 1806. The older monuments were erected before marble had been quarried to any great depth, hence the best material was not obtained. The corner-stone of the Washington monument was laid July 4, 1815, and that of the Battle monument September 12, 1815; the lettering upon the latter remains quite distinct, showing that this material, even when not selected with any care, stands the test of time quite well. The Rialto building, Second street; the Kilby building, Baltimore street; the Franklin Bank, Citizens' Bank, Union Bank, and the Farmers' and Planters' Bank buildings are constructed in part of marble from Cockeysville. The foundations and underpinnings are built of gneiss quarried in the vicinity and at Jones' falls, Ellicott City, and Port Deposit; all of these places are readily accessible by water. Granites from Woodstock, Richmond, Virginia, and from the coast of Maine are employed to some extent for the same purposes. In the construction of the Young Men's Christian Association building, the Normal School building, and the Traders' National Bank building, Berea, Ohio, sandstone was used. About three-fourths of the streets are paved with stone, the material chiefly used for this purpose being cobble-stones and gneiss from Jones' falls and Port Deposit, and granites from Woodstock, and from Virginia and Maine; although brick is the material chiefly used for sidewalk paving, yet much of the North River blue-stone shipped from Rondout, New York, is used for this purpose. Granite from Woodstock, Maryland, and from Richmond, Virginia, and gneiss from Port Deposit, Maryland, are also used for this purpose; the curbstones are of gneiss from Ellicott City and Port Deposit and the granite from Woodstock. The bridge abutments, sea-walls, and the walls of fort McHenry are constructed chiefly of gneiss from Jones' falls and Port Deposit.

BANGOR, MAINE.

The material used for the better class of stone construction in Bangor is granite exclusively, brought chiefly from Frankfort, Maine, and the islands of the Penobscot bay. Underpinnings are of granite. The post-office and custom-house buildings are of granite, chiefly from Musquito mountain, Frankfort. The light granite is largely used in the city for sills, steps, and trimmings generally. The streets are but little paved with stone, and the material is cobble from Mount Desert island and other islands in Penobscot bay, and some also from the vicinity of the city. The sidewalks are paved with brick and concrete, no stone being used for this purpose. Curbstones and crossings are of granite.

BINGHAMTON, NEW YORK.

There is little stone construction in Binghamton, and the material used almost exclusively is limestone from a quarry in the vicinity of Syracuse. A little stone for railroad work comes from Nineveh. The streets are not paved; sidewalks are largely paved with sandstone from the Wyoming blue-stone region in Pennsylvania, and curbstones are of the same material. Some stone from Oxford, Chenango county, is also used for sidewalk pavements.

BOSTON, MASSACHUSETTS.

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HISTORICAL ACCOUNT.

When the first settlers came to Boston, over two hundred and fifty years ago, they probably found the land on which the city now stands covered with an abundant supply of our New England bowlders, which were at once useful in the construction of buildings, just as they are now used in the country; but it seems probable that no ledge of rock was found in the old town, outcropping through the thick clay covering, although there has been some difference of opinion on this point. (a) That they began at once to use stone for houses is shown in the following record: "Oct. 30th, 1630. A stone house which the governor was erecting at Mystick was washed down to the ground in a violent storm, the walls being laid in clay instead of lime." (b) "A few houses were built of stone and some of brick, but these were exceptions to the general rule, until Boston had become over twenty years of age." (c) About 1650 Johnson says of the city, " * * * the buildings, beautiful and large, some fairly set forth with brick, tile, stone, and slate."

There existed until 1864 a stone house built about this time (1650), which was early known as the "Stone house of Deacon John Phillips". * * * "It was built chiefly of stone, the common rocks found in the native soil of

a Cf. *Mem. Hist. Boston*, Vol. I, p. 554, note. S. Godon: *Mem. American Acad.*, Vol. III, 1809, and others.

b Snow's *History of Boston*, p. 40.

c Shurtleff's *History of Boston*, p. 589.

the peninsula having been broken into various shapes and sizes, and laid into place in the rough form left by the maul of the workman, the massive chimneys, with their spacious fireplaces, constructed of large coarse bricks and stones of uncommon size, were, as far as practicable, on the outside of the building, and portions of the house were covered with thick slate stones at the top of each of the stories." (a) Another writer, however, says that "the foundation walls were four feet thick or more; the walls above ground were two feet in thickness, and built entirely of small quarried stones, unlike anything to be seen in this neighborhood, and were probably brought as ballast from some part of Europe." (b)

When Josselyn visited Boston, in 1663, he found many large streets largely paved with pebble, and, near the common, some fine buildings constructed of stone; and Ward said in 1699: "The Buildings, like their Women, being Neat and Handsome, and their Streets, like the Hearts of the male Inhabitants, are Paved with Pebble." In fact for some two hundred years the streets were paved almost exclusively with cobble-stones obtained from neighboring beaches, and perhaps from gravel-pits, until granite blocks began to be used. Drake says that the paving of the public streets began very early, and was made of importance after 1700; the sidewalks were also early paved with cobble-stones and flags. (c)

The red Connecticut sandstone was shipped to Boston very early. In 1665 ordinances were passed in Portland, Connecticut, relating to the use of this stone by outsiders, which seems to have been used in Boston within the first hundred years; thus the Old Province house, erected in 1679, is described as having a flight of twenty massive red freestone steps; the freestone used in 1737 in the Hancock house came from Middletown, Connecticut. In consequence of extensive fires, laws were passed in 1692 and 1699 concerning the construction of stone houses—that of 1692 decreeing, "that henceforth no dwelling-house in Boston shall be erected and set up, except of stone and brick, and covered with slate or tile". It could not, however, be enforced. The old triangular warehouse which stood near North Market street, and was built about this time, had three turrets covered with slate, and slate was used for roofing very early; this was probably in part imported from Wales, in part obtained in Massachusetts. Professor Shaler says on this point:

From the slates and conglomerates of the Cambridge and Roxbury series the first quarried stones of this colony were taken. The flagging slates of Quincy, at the base of Squantum Neck, were perhaps the first that were extensively quarried. A large number of the old tombstones of this region were from these quarries. The next in use were the similar but less perfect slates of Cambridge and Somerville; and last to come into use were the conglomerates and granites that require much greater skill and labor on the part of the quarrymen to work them. At first the field-boulders supplied the stone for underpinning houses and other wall work; so that the demand for grave-stones was, during all the first and for most of the second century of the existence of the town, the only demand that led to the exploration of the quarry rocks of this neighborhood. Indeed, we may say that the exploration of the excellent building and ornamental stones so abundant here has been barely begun within the last two decades. (d)

In the Massachusetts records there is a letter dated 1721 describing a visit to Hangman's island in "Baintry" bay, and to Hough's Neck near Squantum, and a return with a cargo of 20 tons of split slate, showing how extensively it was used even then. The use of stone for walls, steps, and underpinning was constantly increasing, and we find that the inhabitants of Quincy were alarmed at the rapid manner in which the boulders disappeared from their fields, for in 1715 and 1729-30 the town passed laws regulating their use. (e)

In 1737 the old Hancock house (taken down twenty years ago) was built of Braintree boulders, squared and hammered, with red freestone trimmings from Middletown, Connecticut, and it was slated (probably at some later date) with slate from Lancaster, Massachusetts.

From 1749-54 was built King's chapel, now standing on Tremont street—at that time the greatest stone construction ever attempted in Boston, if not in the whole country. It was built of coarse boulders dug out of the ground at both the north and south commons, Quincy (Braintree), and then split and hammered. The boulders were split up for this building, it is said, by heating the stone (by building a fire upon it), and then splitting it by letting heavy iron balls fall upon it; in fact squared and hammered granite had only been used a short time before this in Boston, as the art of working it to a smooth surface is said to have been introduced about this time by German immigrants who settled at Quincy. Of course granite obtained in this way was very expensive and the process could best be applied only to boulders having a free side.

When this work was finished it was the wonder of the country round. People coming from a distance made it an object to see and admire this great structure. The wonder was that stone enough could be found in the vicinity of Boston fit for the hammer to construct such an entire building. But it seemed to be universally conceded that enough more like it could not be found to build such another. (f)

In 1774 the old powder-house was built of Braintree granite, with walls 7 feet thick; and in 1793 the stone light-house was built on Light-house (or Beacon) island.

About this time marble began to come into use for building, corresponding to the opening of the Berkshire, Massachusetts, marble quarries (1790), for the state-house, built 1795-98, is described in old books as having keystones, imposts, etc., of white marble; part of this came from Boynton's quarry in West Stockbridge, Berkshire county. (g) Thus the "new almshouse", erected in 1800, had marble trimmings; and the Exchange coffee-house,

a Shurtleff, *loc. cit.*, p. 666.

b Savage, *Police Record*.

c Old Landmarks, p. 21.

d *Mem. Hist. Boston*, Vol. I, p. 5.

e Pattee's *Hist. of Quincy*, p. 599.

f Chief Justice Shaw, *Proc. Am. Acad.*, 1859, IV, p. 353, etc.

g D. D. Field's *History of Berkshire County*, p. 275.

erected in 1805-'08, had six large marble columns or pilasters upon a rustic basement, supporting an architrave and a cornice of the same stone. The base of the building was of hammered granite and the basement of white marble. The old custom-house, built in 1810, had also marble trimmings.

About the beginning of this century came a turning point in stone construction in Boston and the country generally, coincident with the changes in the method of splitting granite. According to Chief Justice Shaw (*loc. cit.*) this was determined by the introduction of the method of splitting granite by drilling holes and then driving in small wedges. The construction of the first part of the Massachusetts state prison in Charlestown, finished in 1805, seems to have been the cause for the introduction of this method of splitting granite by drilling holes and driving in small wedges, now universally used; so that this building, together with Bunker Hill monument and King's chapel, must be regarded as of great historical importance in the development of granite construction in the United States.

Shortly after the beginning of this century, then, granite began to be used extensively in Boston, and of two varieties; white granite (the so-called Chelmsford) from Tyngsborough and Westford, near Lowell, Massachusetts, and perhaps some from Pelham, New Hampshire, and other places—quarried generally, if not entirely, from loose bowlders for many years; and the dark Quincy granite, mostly from bowlders, but a little from ledges. Thus in 1810 the court-house (old city hall) was built of white Chelmsford stone on the site of the present building, in the walls of which some of the old stone has been retained; in 1814 the New South church was built of the best Chelmsford granite. About the same time, what is now the Congregational house, on Beacon street, was built; the old Parkman house on Bowdoin square, University hall in Cambridge, and others, all of Chelmsford granite; and from 1818 to 1821 the main part of the Massachusetts general hospital, with several large granite columns, was hammered at the state prison—also of Chelmsford stone—probably from bowlders.

The completion of the Middlesex canal to Chelmsford (30 miles) in 1803, itself a great work, with sixteen locks of hewn granite, opened the way for the easy transportation of granite from the vicinity of Chelmsford, so that it could be delivered in the very streets of the city, and great quantities were landed at the state's prison in Charlestown and cut by the convicts. All, or nearly all, of this stone came from surface bowlders, as is stated, as late as 1820, (*a*) and were split as at Quincy; in 1818 a church was built of this stone in Savannah, Georgia, and \$25,000 worth was sold.

In 1818-'19 there was built of this material the first stone block in Boston, still standing on Brattle street, and forming originally a block of fourteen buildings, part of which now form the old part of the Quincy house. Stores erected on Cornhill in 1817 were the first erected in the city on granite pillars, and in 1820 these were first substituted in brick buildings already standing. (*b*) In 1820 Saint Paul's church on Tremont street was built of Quincy granite with large columns and portico of yellow sandstone from Acquia creek, Virginia. Some yellow sandstone from England was used in buildings on Cornhill in 1817.

The mill-dam connecting Boston with Brookline and Roxbury, and built from 1818 to 1821, was considered one of the greatest constructions of the kind in the world. The sides of the dam are built of solid stone for 8,000 feet in length, from 8 to 3 feet thick, and 12 to 17 feet high, while the width between the walls varies from 50 to 100 feet. The stone used was Roxbury pudding-stone and stone from Weymouth.

In 1824 the United States branch bank was built on State street of Chelmsford granite, and has been called the first building constructed of large stone (the state's prison, however, should be noted); a part of this building still remains in its successor, the Merchants' Bank building, and the two columns in the present front were taken from the two in the original building, but reduced in size. These two columns were originally 24 feet high, including the cap, and 4 feet in diameter at the base, and were cut from a large bowlder of granite in Westford, Massachusetts.

The next year the construction of Bunker Hill monument began (1825-1842), the greatest monument of its kind in the world, and marking a most important step in stone construction in this country. The architect was the well-known Mr. Solomon Willard, and the master mason Mr. Gridley Bryant. To these two men is largely due the development of stone construction in Boston.

After his appointment as architect, Mr. Willard spent considerable time in looking up a quarry, and finally decided on the Bunker Hill quarry in Quincy, from which the stone was accordingly taken, and it was for the purpose of transporting to tide-water the stone for the monument that Mr. Bryant built the first railroad in America.

From the *Memoir of Solomon Willard*, by William W. Wheildon, we quote as follows:

The opening of the Bunker Hill quarry led to the discovery and opening of other quarries, caused the building of the first railroad in the country, and gave an impulse to business which has adorned our cities with a class of splendid and substantial buildings, both public and private, which for durability and beauty are wholly unsurpassed.

Mr. Willard felt persuaded that an improvement in the material for building purposes so decided as that which he, in fact, had introduced would gradually effect a change in the style of building and in the general architecture of the times. Granite, as a building material, excepting in a few instances, and these mostly under Mr. Willard's superintendence, had been used in small pieces or blocks of

a W. Allen's *Hist. of Chelmsford, Mass.*

b Snow's *Hist.*, p. 328, note.

moderate size for cellar walls, underpinning, posts, lintels, etc., and his first measure was to introduce the material in large blocks, such as were in themselves massive and durable, which, as he saw at once, would absolutely necessitate changes in the style of architecture and in the character of public buildings, stores, and other substantial structures.

In 1825-'26 the Quincy market was built of Ohelmsford (and Hallowell) granite, with large columns of the same at each end of the building. Soon large buildings were put up of Quincy granite, and the construction of stone buildings went rapidly forward after 1830 to the present time, so that only a general mention is possible:

The Tremont house, 1828-'29, granite; dry dock at navy-yard, 1827-'34; old Trinity church, 1828; Masonic temple (United States court-house), 1830-'31; Suffolk County court-house, 1833-'36; and the United States custom-house, 1837-1843, may be mentioned as opening the great development in the construction of Quincy granite buildings, and as showing how the Quincy granite supplanted the Ohelmsford. In 1848 we find already thirty or forty blocks of granite mentioned in the city. The eight stone columns put in the county court-house (1835) were of importance, each one requiring 65 yoke of oxen and 12 horses to transport it; and also those put up in the Merchants' exchange, in 1842—the largest in the city—may be mentioned. About this time there was a considerable use of the Somerville diabase for basements of brick buildings and of red sandstone for trimmings. About 1845 the red sandstone came in for fronts, and several churches, the Boston Athenæum, etc., were soon erected. The *Times* building on State street is said to have been the first building with a red-freestone front. Rockport granite began to be used from the quarries about 1830, and was at first put into cellars for brick buildings, and then for posts in North and South Market streets. The first building of hammered Rockport stone was that of Terice How & Co., about 1846, and the Beacon Hill reservoir, a little later, of Rockport stone, was a very extensive undertaking. The Parker house, erected in 1854, was the first marble building in the city. Concord granite was first used in columns in the Boston and Albany depot; the Merchants' Bank building was perhaps the first front (1856) of Concord granite. The Washington building at the head of Franklin street is said to have been the first building of Nova Scotia freestone (1858). Within the last twenty-five years various other building stones have been introduced: the Roxbury pudding-stone for churches, the different marbles and sandstones, and lastly the red granites. The building up of the Back bay has been very extensively done with sandstone fronts. The great fire in 1872 wiped out hundreds of stone buildings and blocks which had been erected during forty years in the business portion of the city. The buildings were very largely Quincy granite, Rockport, Concord, Hallowell, etc., and in their places have sprung up buildings of lighter-colored stone, Concord and Rockport granites, and a great proportion of buildings of the yellow sandstones of Ohio and the provinces, together with many marble buildings.

STATISTICS.

According to the assessor's list for 1880 there are about 51,000 dwelling-houses, stores, and other buildings in the city of Boston. The following figures can be compared with those above only approximately, on account of the probable differences in making the count; for in the figures for stone buildings, what appeared to be separate constructions were counted as units, and several dwelling-houses may make up one stone building. There are in the city limits of Boston, by actual count: (a)

	Buildings.	All stone.	Fronts, one to three sides.
Total.....	752	63	659
Quincy syenite (granite)	162	28	134
Concord granite—two or three from Fitzwilliam, New Hampshire.....	79	2	77
Cape Ann granite.....	40	9	31
Ohelmsford granite.....	16	5	11
Hallowell, Maine, granite.....	5	0	5
Rollstone Hill granite, Fitchburg.....	1	1	0
Jonesboro', Maine, red granite.....	5	0	5
Vinal Haven, Maine, granite.....	1	0	1
Somerville diabase (granite).....	1	0	1
Frankfort, Maine, granite (?).....	1	0	1
Unknown granite.....	1	0	1
Total granite.....	312	45	297
Marble (Vermont, etc.)	58	0	58
Tuckahoe, New York, dolomite (marble).....	10	0	10
Total marble.....	68	0	68
Connecticut valley, New Jersey, and the provinces, red sandstone.....	211	3	208
Connecticut valley, New Jersey, and the Ohio, part red, part yellow sandstone....	116	2	114
Total sandstone.....	327	5	322
Roxbury pudding-stone.....	35-40	35-40	0
Cambridge slate.....	3	2	1
Dedham porphyry.....	1	1	0
Unknown quartzite (?).....	1	0	1

a This is a close approximation, but cannot of course pretend to be accurate to a single building.

Therefore between $1\frac{1}{2}$ and 2 per cent. of the buildings of the city are of stone. Some of the more important constructions of the different kinds of stone are:

QUINCY GRANITE.—United States custom-house (1837-'48) is constructed in the form of a Greek cross. It is surrounded by 32 massive stone columns, each of which is 5 feet 2 inches in diameter, 32 feet high, and weighs 42 tons. The roof and dome are covered with granite tiles worked at Quincy; there is said to be about the same amount of stone in this building as in Bunker Hill monument—6,700 tons. The county court-house (1833-'36); there were originally eight stone columns 25 feet 6 inches high and 4 feet 6 inches in diameter, weighing 50 tons each. Suffolk County jail (1851); there is also some stone in the building from the Rockport Granite Company. Charlestown state prison (1805, 1828, and 1850); the old part was probably in large part from bowlders; some of the blocks were 9 feet long and 20 inches thick (1805). United States court-house (1830-'31); Masonic temple; Tremont house (1828-'29); King's chapel, 1754—bowlders; Saint Paul's church (1820); the yellow sandstone columns, etc., from Acquia creek, Virginia; Howard Athenæum (1846); Merchants' exchange (1842), Wigwam quarry. The pilasters in front of this building are the largest in the city; the large ones are 41 feet 8 inches long, 6 feet wide, and weigh 50 tons; Boston Museum (1846); Merchants' National bank (in part); Suffolk National bank; State Street block; State Street wharf building; United States warehouse, Union wharf; Lewis wharf building; Commercial wharf building; Commercial block; Long wharf building; the buildings of Hovey & Co. and of Hogg, Brown & Taylor; Mount Vernon church; Unitarian church, Jamaica Plain; Bowdoin Square Baptist church; Catholic church, Broadway, South Boston; many of the buildings in the navy-yard, Charlestown; United States dry dock; basements of Equitable Life Insurance and New England Mutual, and many other large buildings; lastly, Bunker Hill monument, from the Bunker Hill quarry. The monument has two parts, an inside and an outside; the outside part is in form a square pyramid or obelisk, 30 feet square at the base, and tapering gradually. A pyramid of stone 13 feet high tops this, so that the total height is 221 feet 5 inches. Inside the pyramid there is a hollow cone of stone with a circular section (diameter at base 10 feet), and between the outside wall of the cone and the inside wall of the pyramid are placed the stone steps. There are, therefore, four wrought stone surfaces in the monument extending from top to bottom. There are said to be 6,700 tons of granite; a little of the stone inside is said to be Chelmsford granite. Height of monument to the apex, 221 feet 5 inches; height of obelisk to base of pyramid, 208 feet 5 inches; sides of the square, first course, 30 feet to 15 inches; height of the cone, 196 feet 9 inches; diameter, 10 feet to 6 feet 2 inches; pyramid 13 feet high; sides of base 15 feet.

CAPE ANN GRANITE.—The United States post-office (1869-'82) is the finest granite building in the city. The stone was all furnished from Gloucester, the basement of darker stone from the Blood quarry, and the superstructure from the "Old Pit" quarry. The superstructure of that part of the building first erected was taken essentially from one immense sheet in the quarry; the stone is syenite. The pavement on the floor is from Swanton, Vermont. Lake Champlain, Sicilian, and Sienna marbles have been used in the interior; the roof is slate, from western Vermont. The Boston water-works is an immense granite structure on the side of Beacon hill; the basin is of Westford granite. Lawrence building, Fremont street; the building of Bigelow Kennard & Co., Washington street; Wesleyan hall; Commonwealth building, Water street; Saint Vincent de Paul church, South Boston; church of Our Most Holy Redeemer, East Boston; the rope-walk at the navy-yard, 1,360 feet long; South Boston Savings bank, and many stores on the business streets.

CONCORD GRANITE.—*Herald* building; *Transcript* building; Wentworth building; Emigrant Savings bank; city hall; Massachusetts Historical Society building; Suffolk Savings bank; Horticultural hall; Masonic temple; the *Advertiser* building; Merchants' National bank; National City bank; Lawrence building, Devonshire street; Rialto building; New England Mutual Life Insurance Company's building; building corner Summer and Bedford streets; building on Winthrop square; Brooks estate, Pearl street; Union Institute for Savings, Bedford street; Bowditch block, South street; Odd Fellows' Memorial hall (in part), 27-50 High street; and Cruff's block on Pearl street, from Fitzwilliam, New Hampshire.

CHELMSFORD GRANITE (WESTFORD, etc.)—Massachusetts general hospital, the original part (1818-'21) from bowlders, probably hammered at the state's prison; addition of 1846 from Westford. Quincy market (1825-'26) with some Hallowell granite; two blocks of stores, north and south of the market; church of the Immaculate Conception; Congregational house; Somerset club, Beacon street; Quincy house (old part); Parkman house; part of the Merchants' National bank and new city hall; basin of Boston water-works.

HALLOWELL, MAINE, GRANITE.—Equitable Insurance Company's building; Odd Fellows' Memorial hall (part Concord); some in Quincy market; Mutual Life of Maine, Tremont street; National Bank of the Republic; large block in Winthrop square (in part).

ROLLSTONE HILL, FITCHBURG, MASSACHUSETTS.—Fitchburg depot (1847).

JONESBORO', MAINE (Bodwell Granite Company), RED GRANITE.—Wellington Brothers' building and Nevin Brothers' building, on Chauncey street; the Morse block, South street; and the Preston building, Summer street.

SAINT GEORGE, NEW BRUNSWICK, RED GRANITE.—Bedford building, Summer and Bedford streets.

VINAL HAVEN, MAINE, REDDISH GRANITE (Bodwell Granite Company).—Building corner Kingston, Bedford, and Columbia streets.

MEDFORD OR SOMERVILLE BLACK GRANITE (diabase).—Front, corner Harrison avenue and Way street.

PORPHYRITIC GRANITE FROM FRANKFORT, MAINE.—Gernish block (1849).

MARBLE.—Goldthwaite & Co.'s store, Washington street: from Sutherland Falls, Vermont; Commonwealth hotel, Continental block, Washington street, Boston Penny Savings bank: from Pittsford, Vermont; Parker house, on School street (1854): from Rutland, Vermont; Blackstone National bank, Commonwealth Insurance Company: from Pittsford, Vermont; Bowdoin building, Bedford building, Summer and Bedford streets: from Sutherland Falls, Vermont; Rogers' building, hotel Comfort: from Rutland, Vermont; building corner Franklin and Pearl streets: from Sutherland Falls, Vermont; Saint Cloud hotel, hotel Dartmouth: from Rutland, Vermont; old part of hotel Vendôme, Italian marble; Richardson building, Devonshire street: from Lee, Massachusetts; block of stores on Pearl street (Nos. 113-151): from Alford, Massachusetts.

TUCKAHOE, NEW YORK, MARBLE (DOLOMITE).—Sears' building; McCullar & Parker's building; Mason & Hamlin Organ Company's building; Chandler's building, Devonshire street; large building corner Devonshire and Franklin streets; New York Mutual Life Insurance Company's building, one of the finest stone buildings in the country: from the quarry at Tuckahoe, New York; Montgomery building, Summer and Chauncey, hotel Vendôme (new part): from Tuckahoe, New York.

RED SANDSTONE FROM CONNECTICUT VALLEY AND NEW JERSEY.—Church of the Messiah, Florence street (1848): from New Jersey; 681 Washington street: from Longmeadow, Massachusetts; Evans house: from Portland, Connecticut; hotel Pelham: from Portland, Connecticut, and New Jersey; Brewer building: from Connecticut; Boston Athenæum: from Little Falls, New Jersey; Second Unitarian church, Boylston street: from Newark, New Jersey; Arlington Street church: from Belleville and Little Falls, New Jersey; five houses on Mount Vernon street: from Portland, Connecticut; and great numbers of fronts in the Back bay and elsewhere.

RED SANDSTONE FROM THE PROVINCES.—Wilde buildings, New Washington street: from Mary's Point, New Brunswick; buildings of Palmer, Batchelder & Co., Jordan, Marsh & Co., Boylston bank, Young Men's Christian Union, Boylston street; Channing building, Franklin street; Howard buildings, Arch street; Richardson's building, Federal street: from Bay View, New Brunswick; Bristol building, Boylston street: from Wood's Point, New Brunswick; bank building in Charlestown: from Bay View; Liberty building: from Wood's Point; buildings of Currier & Chamberlain, Washington street, and Minot, Hooper & Co., Ringston street: from Mary's Point; many fronts in Back bay and elsewhere.

YELLOW TO WHITE SANDSTONE FROM BERE A AND AMHERST, OHIO, AND FROM NOVA SCOTIA AND NEW BRUNSWICK, ETC.—Saint Paul's church (1820), columns, etc.: from Acquia creek, Virginia; Wilde buildings: from Caledonia, New Brunswick; Associates' building (Leopold Morse & Co.): from Berea, Ohio; buildings of Palmer, Batchelder & Co.: from Caledonia, and Mary's Point; Shreeve, Crump & Low: from Amherst and Berea, Ohio; R. H. White & Co.: from Amherst, Ohio; Boylston Bank building: from New Brunswick Freestone Company; Dobson's building: from Amherst, Ohio; Call & Tuttle, 459 Washington street: from Caledonia, New Brunswick; hotel Boylston: from Amherst and Berea, Ohio; Young Men's Christian Union: from Amherst, Ohio; Tremont National bank: from Bay View; Simmons' building: from Berea, Ohio; Metropolitan National bank: from Amherst, Ohio; Angelo building: from Ohio; Minot, Hooper & Co.: from Bay View; Harvard College building, Arch street: from Amherst, Ohio; Richardson's building, Federal street: from Bay View; Rice, Kendall & Co., Federal street: from Berea; Alexander building, Washington street, and Sargent's block, Lincoln street: from Mary's Point and Caledonia, New Brunswick; extension Young's hotel: from Caledonia, New Brunswick; Rand, Avery & Co., Mason building (trimmings): New Brunswick freestone.

ROXBURY CONGLOMERATE OR PUDDING-STONE.—First church, Marlborough and Berkeley streets; Brattle Square church; Central Congregational church, Beilseley and Newbury streets; Emanuel church, Newbury street; new Old South church; Second Universalist church; Tremont Street Methodist Episcopal church; cathedral of the Holy Cross; Saint James (Episcopal) church; Mission church, Tremont street; Saint Peter's church, Dorchester; Saint Columbkille church, Brighton; Saint John's church and the Bussey institution, Jamaica Plain, and several others.

SOMERVILLE OR CAMBRIDGE SLATE.—Saint Francis de Sales church, Charlestown.

DEDHAM PORPHYRY OR FELSITE.—Trinity church, from Mr. Bullard's quarry, Dedham.

The city has been very fortunate in having close at hand such an excellent stone as the Roxbury conglomerate for certain purposes. It has been used almost entirely for churches, the stone being so laid up that the exposed surface is that of a natural joint, the rusty-brown color of which is very effective in massive buildings; but of course this use of joint surfaces adds to the expense.

In the trimmings of buildings the red sandstones of Connecticut valley, of New Jersey, and of the provinces have been universally used with brick, and also the yellow sandstones to a considerable extent, while the granites have been used somewhat, especially in the large brick buildings. With the Roxbury conglomerate red and yellow sandstone are used, but the Catholic churches seem to prefer Rockport granite. The new Old South is trimmed with yellow sandstone from Amherst, Ohio, and red sandstone from Longmeadow, Massachusetts. Quincy, Rockport, and Concord granites are the most used for trimmings and supports; also granite from Spruce Head and Hallowell, Maine. The new Boston and Albany depot is trimmed with two shades of the gneiss from Monson, Massachusetts. The

Mechanics' Charitable Association's new building has steps, etc., from Sullivan, Maine. The Boston and Albany Railroad round-house, East Boston elevator, etc., are trimmed with granite from Braggville, Massachusetts. In Gilman & Cheney's building, Charlestown, granite from Deer Isle, Maine, has been used. Red granite from Westerly, Rhode Island, has been used in some churches. Coarse porphyritic granite (Frankfort, Maine) has been used in houses on Harrison avenue.

Marble has been used for trimmings in some large buildings, and the Tuckahoe dolomite a little, *e. g.*, in a house opposite the state-house. The blue or dove marbles have been used in several buildings of white marble; that in the Sears and Montgomery buildings is from Dover, New York; another dove marble (Rogers and other buildings) comes from Rutland. The gray marble from Isle La Motte, lake Champlain, has been used for trimmings in a few buildings (Summer and Pearl streets). In the Richardson building on Federal street the beautiful green serpentine from Chester, Pennsylvania, has been used with marble, but it has crumbled badly with the exposure; the same stone used in Philadelphia has stood well (University of Pennsylvania buildings). The Hudson River blue-stone has been used for trimmings with Tuckahoe marble in the building corner Devonshire and Franklin streets. The bright red sandstone from Potsdam, New York, has been used a little (columns and trimmings of house Myrtle and Hancock streets, and in Raynor block, in Union street).

For polished granite ornamentation there has been a considerable use in columns on the exterior of buildings (red Scotch, Saint George, New Brunswick, Red Beach, and Jonesboro', Maine); dark red and pink Quincy and gneiss columns (new Old South church). In Wellington Brothers' and Nevin Brothers' buildings are polished columns of Vinal Haven, Maine, granite. In the Wentworth building are columns of the porphyritic Shap granite (English); in the hotel, Boylston avenue, some very beautiful columns of red Quincy; the dark may be seen in the Tremont National bank, Providence depot, and many other buildings. In the *Herald* and Bedford buildings may be seen polished Saint George granite, Scotch and Jonesboro' in many others. At No. 55 High street, in the Mason building, the Bedford building, and elsewhere the underpinning or granite supports are of polished work.

For foundations the granites of Quincy and cape Ann, together with Cambridge slate and Roxbury stone, are used. The Somerville diabase was extensively used forty years ago, and about forty-five years ago the rails of the Lowell railroad from Boston to Medford were laid on a foundation of this stone from Dane ledge, Somerville.

For underpinning, Quincy, Rockport, and Concord granites are generally used; red and yellow sandstones also very extensively in dwellings. In Charlestown the Somerville slate and in Roxbury and Jamaica Plain the conglomerate are largely used, on account of the proximity to the ledges. Hallowell, Spruce Head, Vinal Haven, Deer Isle, and other granites have been used. In the very old houses one sees generally the white Chelmsford granite, looking very rough, as the bush-hammer had not been invented forty years ago. At that time the Somerville diabase was very extensively used for underpinning in Tremont and Hanover streets, Harrison avenue, and in the neighborhood of the Charles Street jail. In many of these old streets the Connecticut sandstone was profusely used, and, being of poor quality then, shows the effects of the frost very plainly. Marble and Hudson River blue-stone have also been used. The handsome granite basement of the Art Museum building is from Mr. Corliss' quarry at Randolph, Massachusetts.

Posts and walls are made generally from the varieties of granite—Quincy, Rockport, and Concord; mainly for posts, Spruce Head diabase, etc.; the granites and sandstones for steps; for walls, Quincy, Rockport, Concord, and Chelmsford sandstone, conglomerate, and slate.

As mentioned before, the streets were early paved with the cobble-stones from the beaches, and these were generally used until about 1840, when Mr. Willard laid the first paving blocks of Quincy granite in front of the Tremont house; they were very large at first—18 inches by 14 feet—but became smaller until about a foot square. For a while (1856) blocks of trap from Bergen hill, New Jersey, were used, until in 1858 Mr. Henry Barker, of Quincy, introduced the small granite pavers which have since been universally used. At present the paving stones come from Rockport, Quincy, and the Maine quarries—all of granite. Granite curbs were used long ago; at present Quincy and Rockport furnish most; some are of Hudson River blue-stone. There are 355 miles of public streets and about 410 miles in all; of these 67 miles are paved.

Sidewalks were flagged or paved in this century. Before the North River flagging came into use in the city, quantities of the Bolton, Connecticut, flagging (a mica-schist, wearing down easily) were laid down. Pemberton square is still largely flagged with these, and many other places in the city, where it still lingers. At present, while brick is generally used, the business streets are flagged with North River stone and granite flags, the granite principally from Rockport and Quincy. Red sandstone flagging is used once or twice. For crossings, North River stone and granite; a great deal of the granite comes from the old-fashioned paving blocks. For the catch-basins of the sewers Rockport granite is largely used. In some of the old city sewers pudding-stone has been used for side walls, and especially for culverts; in some cases the old brick sewers were covered on top with slate. In the improved sewerage construction at Moon island considerable masonry has been used in the pumping station—the granite from cape Ann, Quincy, and Mount Desert.

The reservoir of the Boston water-works on Beacon hill has been described. At the Chestnut Hill reservoir the lining is trap and pudding-stone with a cap of Douglass mica-schist. The East Boston and South Boston reservoirs are lined with Quincy granite. The Parker Hill reservoir has a pudding-stone wash-wall with cap of

granite from Graniteville, Massachusetts. The Mystic reservoir has a granite cap. The Sudbury River conduit crosses Charles river over a bridge 475 feet long, of granite from the Cape Ann Granite Company; and the Waban Valley bridge of the same, 536 feet long, is from Spruce Head and Deer Isle, Maine. Three dams are built of Farmington and Cape Ann granite, etc.

The abutments of the Boston bridges are of granite from Quincy, Cape Ann, and various other places; the West Chester Park bridge, for instance, is of Milford, Cape Ann, Deer Isle, and Mount Desert granite. For the walls and abutments and other stone-work of railroads, granites, pudding-stone, diabase, slate, etc., are used; the Braggville granite was used quite largely by the Boston and Albany railroad.

For the sea-walls surrounding the city, Rockport and Quincy granites, Somerville diabase, pudding-stone, etc., have been used. In the sea-walls built extensively in the harbor on Galloup island, Point Allerton, Long island, etc., granite has been used—a great deal from Biddeford and Bamebrush, Maine.

Forts Winthrop, Warren, and Independence, in the harbor, are of granite from Quincy, Rockport, and other quarries. Boston Light and Minot's Ledge light-houses are of stone.

ROOFING.—The John Hancock house and old state-house were slated from Lancaster; but the Welsh slates were used in Boston probably two hundred years ago. The Lancaster quarry furnished great amounts of slate to the city after the Revolution, and the slate quarries near Brattleboro', Vermont, furnished slate early in this century. About thirty-five years ago the slates from western Vermont and the Maine slates came into use for roofing, and their use has steadily increased until very little Welsh slate is now used. At or after the time of the war, slate from Buckingham county, Virginia, was used in many buildings of the city. At the present time the roofing slates used come from Piscataquis county, Maine, and from Vermont, Pennsylvania, New York, and Wales. The green, red, and purple slates of western Vermont, and New York state, etc., are extensively used. We may mention the following examples: Trinity church (in part), Clarendon Baptist church, and Saint Mary's cathedral: from Brownville, Maine; new Latin school: from Monson, Maine; cathedral of the Holy Cross, Park Street church, and Bowdoin Square church: Welsh-Penrhyn; navy-yard buildings: Maine and Welsh; Lowell Railroad station and city hall, Charlestown: Pennsylvania slate; post-office, and Eastern Railroad station: Vermont slate; Baptist church in Cambridge: Virginia slate.

The use of slate by marbleizing for mantels, chimney-pieces, tables, etc., began about thirty years ago; and it is used for tiling, slabs, etc., as elsewhere in the country.

Ornamental marbles were in use at least thirty-five years ago in Boston; the "black and gold", Bardillo, and Italian dove were most used then, and the others gradually came in—the German marbles last. The use of the blue marbles of Dover, Pittsford, and Rutland in the exterior trimmings has been mentioned; some of the other veined marbles have been slightly used (Sears building), and the Winooski Vermont marble in columns (Masonic temple), and black marble (Parker house). In the interiors of buildings the ornamental marbles have been frequently used, and in great variety, *e. g.*, the Art Museum, New York Mutual, *Herald*, Marlborough, and many other buildings; and of course considerably for mantel-pieces, soda fountains, etc. The following have perhaps been most used in the city:

Yellow Sienna: Italy; Saint Baume, Jaune Fleuri, and Lumachelle, France.

Black: from Glens Falls, New York, and elsewhere.

Red: Lisbon, Portugal; Victoria or Irish red; Griotte, France and Spain; Echaillon, France; Formosa and Bougard, Germany; Brocatello, Italy; East Tennessee, red, brown, chocolate, and pink; rouge and garnet, France; Larancolin, France; red and pink, etc., from lake Champlain.

Green: Geneva, Alps, Campagna, and the Marie, New York, marble (columns in entrance to Art Museum). The red slate is used with the colored marbles.

Blue: Dover, Rutland, and Pittsford. In tilings, slate, red slate, Italian and Vermont white marbles, Lake Champlain black marble, and the Swanton red marble are largely used.

The monuments and statuary distributed through the parks and squares of the city have necessitated a considerable employment of stone. The Hamilton statue on Commonwealth avenue, of gray granite, is said to have been the first in the country made of granite (1865).

The soldiers' and sailors' monument, on the common, and that of Charlestown, are of granite from Hallowell, Maine. The Dorchester soldiers' monument, on Meeting-House hill, is of Gloucester red granite.

The Ether Monument group of statuary in the public garden is of Concord granite, as is also the Good Samaritan group of statuary; the figures on Horticultural hall are of Fitzwilliam, New Hampshire, granite; the pedestal of the Franklin monument, city hall, and the Warren statue, Bunker hill, are of Roxbury, Vermont, serpentine; the polished bases of the Winthrop and Prescott statues are of Jonesboro', Maine, red granite; also that of the Emancipation group. Quincy granite is used for the Adams, Washington, and many other bases; the soldiers' monument in Jamaica Plain is of Clark's Island, Maine, granite, with Quincy base; and the statue of Josiah Quincy, city hall, has a green verd-antique base.

One of the earliest applications of stone was in the city cemeteries. The principal old burying-grounds, those of King's chapel, Copp's hill, the Granary, Charlestown, and Roxbury, are much alike in the kinds of stone used. Some of the oldest tombstones are of porphyritic greenstone taken, presumably, from boulders. The Welsh slate

was extensively used (often to be told by lines of color crossing the slabs) with American slate, foreign and American marble, and sandstone. In the King's Chapel ground may be noted the apparently early use of marble: a small tomb of shell marble reads 1702; the Wintthrop tomb is supported by four marble columns. The Granary burying-ground is much similar; red, green, and blue slate tombs have been used principally. The Franklin monument is of Quincy granite. At the large cemetery of Copp's hill we find much the same stones—red and greenish, Welsh, bluish American marble, yellow and red sandstone, and Vermont slate. In the Charlestown cemetery the John Harvard monument is of Quincy granite (1828).

The weathering of the stone in these old places is noteworthy. The Welsh slates, some of which have stood two hundred years, are often almost unaltered, looking very fresh; the greenstone tombs have also stood the weather well. In a slate slab at Copp's hill, having alternations of sandy layers parallel to the surface of the slab, one of these sandy layers has been eaten out, leaving the unsupported thin layer of slate to cave in; the slates are occasionally cleaned by the weather. The red and yellow sandstones, when standing upright, have almost always crumbled or scaled off, and the marbles have suffered. One case of this is a vertical slab at Copp's hill, about forty years old, of a coarse marble; below the ground it retains largely its original smoothness, but above the ground, on the northeast exposure, the action of the rain and atmosphere has dissolved out the cement of the grains of the marble, leaving the isolated grains sticking out like sandpaper; on the sheltered side there is a marked difference. Another large imported marble monument, some seventy years old, has weathered so that the shells embedded in the marble stand out in relief, and the stone is also covered with fine cracks, which, widening and admitting the black soot from the air, give it a peculiar appearance.

In the recent cemeteries of the city there has been an immense consumption of stone for monuments and curbing.

In Mount Auburn, in Cambridge, marble has been most used for monuments, and there are many fine pieces of statuary made from it; the Italian marble for the finer pieces, Vermont marble somewhat, and the pink Tennessee marble. Since the introduction of granite-polishing at our quarries there has been a great increase in the proportion of granite monuments. Quincy granite has been used since the opening of the cemetery, and there are many polished monuments of this stone. The light Mason, New Hampshire, granite is abundantly used here in polished monuments and curbing; also the Rockport granite and that of Concord. There are some fine monuments and tombs of Hallowell granite (the Sphinx and the Charlotte Cushman monument). Westerly granite has been somewhat used. Polished red-granite monuments are plentiful—Scotch, New Brunswick, and Maine. The Shap granite is used in a few cases; also some other granites. There are several tombs and monuments of the Somerville diabase, and a recently-polished one of diabase from Maine (Addison Point?). Both yellow and red sandstones have been used. The Winter monument consists of a large shaft of soap-stone coming, I believe, from a quarry in the east part of Andover forty years ago.

The weather shows its effects at Mount Auburn as elsewhere. Some of the old marble tombs have the roughened surface (by solution of the lime) previously mentioned; others, however, have stood as long without the same evidence of changes, especially the fine-grained marbles. In one tomb of a medium coarse white marble, in a course at the top part of the structure, the marble has disintegrated as follows: On the corner pieces and sides the marble cracks almost imperceptibly; along these cracks the cement of the grains (or some of the grains) is slowly dissolved out, leaving the coarse grains, and these finally crumble off in powder. As this continues, whole lumps are loosened and fall off, breaking into powder; in this way one of the corners has entirely crumbled to loose grains which may be taken up by the handful. The tombs made of the different granites have been slightly affected by the weather, consisting in a change of color; this is most marked in the Quincy; the light granites occasionally show a rusting of the feldspar. The diabase tombs have turned a rusty brown, the change apparently occurring in the black minerals (augite, mica, etc.), while the feldspar whitens. It is very noticeable here that grains of pyrite in the stone are generally bright, without patches of rust about them; one large shaft of the stone, finely bushed, has been little affected by the weather. Many of the red-sandstone tombs have exfoliated considerably; there is one curious case of a large tomb of this stone in which ivy had been trained up the face of the stone, but the continual peeling off of the layers afforded the tendrils no support.

Forest Hills cemetery.—The marbles are generally white Italian, bases often of Vermont marble. There are some very large tombs of marble; in one of them the Tuckahoe, New York, marble is used. There are a number of very beautiful monuments of the polished white Westerly, Rhode Island, granite; many of Concord, Quincy, and Rockport granite. The Randolph, Massachusetts, granite, with greenish spots, has been used in several polished monuments, and a gneissoid granite also. There are many fine examples of red granites—Scotch, Saint George, and Maine. A black granite (diabase) from Addison Point, Maine, has been recently used in a polished monument. The brownish-red Quincy is used in some beautiful shafts; also Shap granite; occasionally red and yellow sandstones; Rockport, Concord, Quincy, and other granites for curbing.

In Mount Hope cemetery there has been nearly a similar use of stone. The Odd Fellows' monument, with large carved granite figures, is of Hallowell granite with two courses of polished red granite; on the posts in front are two polished spheres of Quincy. The Army and Navy monument is a large structure of Concord granite; marble is used extensively as before—Quincy, Rockport, Concord, Mason, New Hampshire, Westerly, Randolph, etc. There are

several monuments of Aberdeen granite, New Brunswick red, etc. The Vinal Haven, Maine, reddish granite has been used in polished work, and Hallowell granite also. For curbing, Quincy, Rockport, Hallowell, Chelmsford, Milton, and Randolph granites. The red Tennessee marble in a few monuments.

At Woodlawn cemetery, in Everett, besides Italian, Vermont, and Tennessee marbles, Quincy, Hallowell, and others are used. There is considerable use of Vinal Haven granite; in one tomb there is the combination of Vinal Haven red, Spruce Head white, and black granite (diabase), all from Maine. Shap granite and the red granites are frequent. There is a shaft of dark soap-stone, probably from Andover.

WEATHERING OF STONES.—The climate of Boston must be one of the most trying ones in the country for building stones, as far as natural atmospheric causes are concerned; for in the winters there is a more or less frequent alternation of damp, rainy, and warm days with those of intense cold, while the rain-storms are violent; yet the deleterious effects of smoke and other products of certain manufactories are largely wanting; the changes in the stone are hence due to the character of the stone itself, and to the defects in it; at the same time most of the stone buildings have not stood long enough to develop a marked change in the stone.

The granites have generally been affected by chemical change alone in some of the constituent minerals, as is evidenced by a change of color—an effect of a higher degree of oxidation of the iron; but they have generally not crumbled. The Quincy granite, since it is found in the buildings that have stood longest, and since it contains a dark feldspar, shows often the signs of change. The stone is of many shades: blue, greenish-blue, pink, reddish, brown-gray, and grayish-black, these being the colors of the feldspar, the mineral in which is found the change, if there be any. This turns liver-brown, rusted-red, yellow or white; often the whitening of the feldspar, with the white look of the quartz, causes the bush-surface to appear almost white. The hornblende seems less frequently affected, turning green and rusty brown. Some of the Quincy stone has stood for years without any very noticeable change of color. Perhaps the Boston custom-house shows best in one building the differences in the weathering, the color remaining unchanged in some cases, in others having become a deep brown, differing in the separate blocks, and even in different ends of the same block.

The light granites (Hallowell, Concord, etc.) have naturally not changed much in color, nor have the buildings been standing long. The principal change observed seems to consist in a dull whitening of the feldspar, and an occasional rusting of that mineral to a yellow color. The white granite from the vicinity of Chelmsford, which was used so extensively in Boston fifty to sixty years ago, shows almost universally in the old buildings a change in the feldspar to a honey-yellow; this is perhaps in part due to the fact that almost all this granite was then quarried from loose bowlders, and of inferior quality to that obtained from ledges. This can be seen in the Massachusetts general hospital, the central part of which—erected in 1818-'21, of stone derived presumably from bowlders—shows the yellow weathering, while the wings, of stone quarried in 1846, are almost unchanged (the garnets scattered through some of the old stone have not changed); part of this difference may be due to the difference in the date of erection.

A red granite from Gloucester has not rusted and faded, but it has been but little used in the city.

The marble buildings have not been standing long and do not generally show a perceptible change, except in the blackening and roughness of the surface. The veined ornamental marbles when exposed out of doors have generally suffered by the removal of the softer parts of the veins. This is notably shown in the pedestals, of veined serpentine marble, of the two statues in front of the city hall—one erected only four the other some twenty-five years ago. The calcite veins in the serpentine have become roughened by the weather, and cracks, which widen so that pieces fall out, often form along them; this is much more marked on the flat surfaces. The green Roxbury, Vermont, serpentine, in consideration of its twenty-five years' exposure, has stood the weather well. The green serpentine used in one building has crumbled on the surface like sand.

The red and yellow sandstones used so extensively in the city vary in character so greatly, even in the same building, that it is difficult to make general statements. Many years back a great amount of red sandstone from the Connecticut valley and elsewhere was brought to Boston, and can now be seen in many of the older brick houses; it was generally coarsely stratified, and, moreover, was laid up with the stratification or layers perpendicular instead of horizontal, the consequence of which has been a frequent cracking, opening, and falling off of pieces. Where sandstone pillars were thus made, it can often be seen how the split began at the bottom, where the free edges of the layers were exposed and worked up. The introduction of better and more homogeneous stone from the quarries of the valley, from New Jersey, and from the provinces, and greater care by the builder, have largely done away with this; yet still cases of scaling off are seen. The other change in the red sandstones has been in the depth of the red color.

The yellow sandstones of different shades from New Brunswick, Nova Scotia, and northern Ohio have been very variable in their character, the same quarries furnishing apparently both good and bad stones. None but homogeneous sandstones of this class have been in general use, and there have been two main changes by weathering, exfoliation, and falling off of pieces, owing to incoherency of the particles, giving the stone a rough appearance; and also rusting of the iron in the stone. The latter has been most noticeable, and occurs either by a uniform change of color in the whole block of stone or only in patches; or else there are parallel layers in the stone, some of which rust while others do not; and consequently when the face of the stone is cut across these

layers we have rusty bands crossing it at intervals. This can be seen very markedly in some of the buildings of the city, and poor selection of the stone must be partly the cause. In many buildings, however, the yellow sandstone has stood unchanged; a good example of this is the Washington building, of Nova Scotia stone, erected over twenty years ago.

Occasional changes of color in slated roofs are observable in the city, especially in the green slate, which often changes to a yellowish-red. The black slates have rusted, especially in buildings where cheap slate has been used, and the purple slate changed to reddish; but these seem rare. The Bolton mica-schist, having hard quartziferous tongues in the softer rock, has worn down by the passing feet, leaving these tongues in relief in peculiar shapes.

Movements of the ground have occasionally occurred, especially in the older streets, cracking the sills, and in some cases two motions in opposite directions appear to have affected one block of stone, cracking it twice.

BRIDGEPORT, CONNECTICUT.

Portland brownstone is the material usually employed in Bridgeport for the better class of stone construction. Gneiss from Greenwich, and granite to a limited extent, are used for the same purposes. The foundations and underpinnings are of gneiss from the local quarries. A long line of wooden wharves along the water-front is backed with stone walls of very rough masonry built of the gneiss from local quarries. The west approach to the Central bridge across the harbor is faced with cut stone with a dressed granite coping. The intermediate piers and draw-pier are built of the same material. The approach is 300 feet long and 41 feet wide. The railroad draw-pier and east abutment are built of Greenwich stone. Bridgeport harbor and Black Rock harbor, both within the city limits, have each an extensive breakwater, the first of stone quarried a little north of Lyme on the Connecticut river, a quarry not now operated. There is a substantial wall, over half a mile in length, of stone from local quarries. The streets are but little paved with stone; the material used is trap-rock from New Haven. Many of the sidewalks are paved with North River blue-stone, and the curbs are of the same material, with some gneiss.

BURLINGTON, IOWA.

Most of the limestone quarried in Burlington disintegrates and exfoliates on protracted exposure to the weather and to the action of frost. It appears, however, to be tolerably durable when protected as in underground work. This imperfection of the stone, the cost of transporting better building stone, and the cheapness of lumber and brick—the city having access to extensive lumber regions on the Mississippi river, which is the natural route of communication with the northern pineries—have very much restricted the use of stone. The banks of the Mississippi in this region are covered with loess or rearranged drift material suitable for the manufacture of brick. This has also had its effect in preventing the use of stone as a building material. There are no natural obstacles to the use of heavy building materials. The substratum which is found at a limited depth being formed more or less with compact limestones, the glacial drift and calcareous clays forming the superficial soil are themselves so compact and firm as to largely obviate the necessity of paving the streets. The city sewers are the most important works in which stone is employed. They are mainly constructed of limestone quarried within the city limits, either by quarrymen in temporary quarries, or by contractors in grading streets. There are some sidewalk pavements of limestone flagging from Sagetown, Illinois, and Mount Pleasant, Iowa.

CAMBRIDGE, MASSACHUSETTS.

The materials employed for the better class of construction in Cambridge are Quincy, Rockport, and Concord granites, Somerville diabase or trap, Somerville slate, and Roxbury conglomerate. The foundations are of slate from the Somerville quarry, and diabase from the same place, with some granite from Rockport and Quincy. The underpinnings are built of granite from Rockport, Concord, and Spruce Head, in Maine. The soldiers' monument on the common is built of Mason, New Hampshire, granite. For posts, the Somerville diabase, and Rockport, Quincy, and Concord granites have been extensively used. In the sewers the Somerville slate has been employed for the sides, and slate and granite for the top. For the stones at the entrance to the catch-basin Rockport granite and North River blue-stone have been used. There are no stone bridges of large size. In the sea-walls about East Cambridge the Somerville diabase has been largely used. There are about a hundred miles of graded streets in this city, and about 2 miles are paved with granite chiefly from Quincy; three-quarters of a mile is paved with cobble-stones. A few of the sidewalks are paved with the North River blue-stone; the curbs are of Rockport granite with a very little blue-stone.

CAMDEN, NEW JERSEY.

The materials used for stone construction in Camden are, for foundations and underpinnings, gneiss from the quarries near Chester, Pennsylvania, and sandstone from Greensburg, New Jersey. For the better class of stone construction serpentine from Delaware county, Pennsylvania, Vermont marble, Trenton freestone, Connecticut brownstone, and Ohio sandstone are used. Philadelphia pressed bricks are the material chiefly used in the walls

of buildings. The Ohio sandstone, used to a limited extent, is well esteemed here. Berea, Ohio, stone was used in the construction of the court-house. The serpentine tends to crumble and split in winter, and breaks under heavy pressure. The streets are largely paved with stone, and in the portions which are paved with rectangular blocks Connecticut stone is used. Much of the pavement is cobble-stone from the Delaware river above Trenton, but there is but little stone sidewalk pavement, brick being the material mostly used for sidewalks. Slate from Lehigh county, Pennsylvania, is used to some extent for this purpose, and also trap-rock quarried near Lambertville; the curbs are of Connecticut granite.

CANTON, OHIO.

Canton is situated but a few miles from the important and extensive stone quarries located on the Massillon sandstone at Massillon. It is almost the only material used in stone construction in this city. In a few instances, where very fine carving and finishing were desired, Berea and Amherst sandstones were used, as the Massillon stone is too coarse-grained to answer well for these purposes. There are but four or five buildings in Canton entirely of stone; a few have fronts of stone as high as the second story, and quite a number have much stone in their composition in the way of corners and heavy caps and sills. The stone sidewalk pavement is almost entirely of Berea sandstone. The Massillon sandstone is not often found in layers of convenient dimensions for paving flags. The streets are largely paved with stone, cobble-stones from the drift near the city being used.

CEDAR RAPIDS, IOWA.

The stone from the local quarries is practically worthless for purposes of construction, and the freight is such on the Anamosa limestone as to render it too costly to compete with brick and timber. Much of the Anamosa material is objectionable on account of lack of strength and durability. The Farley stone is better, being more uniformly good, but the cost of shipment prevents its extensive use. Some stone has been moved from near Mount Vernon to Cedar Rapids within the last year or two. In some cases builders have placed Anamosa limestone on edge in caps, sills, corners, etc., of brick buildings with the result, which might have been foreseen, of causing its gradual exfoliation and separation into extremely thin laminae. Much of the stone is indeed unfit for curbstones on account of its tendency to exfoliate on exposure. The piers of one or two bridges across the Cedar river are of limestone from Anamosa. Magnesian limestone of Niagara age, quarried at Stone City, Jones county, Iowa, was used in the construction of the Carpenter block, Third Ward school-house, city jail, and post-office. There are no other important stone structures. Caps, sills, water-tables, etc., are of Anamosa limestone; the bases for monuments, and a few curbstones, are from Farley, although the Anamosa limestone is also used to some extent for these purposes. The streets are not paved; there are a few blocks having stone sidewalk pavements of Anamosa limestone; curbs are of Anamosa and Farley limestones.

CHATTANOOGA, TENNESSEE.

In the city of Chattanooga stone is just coming to be used to a considerable extent for purposes of construction. In the valley where the city is located there are two formations of Lower Silurian age, the Nashville and Trenton, and the Knox or Quebec dolomite. The latter has been used to some extent, but is rather cherty, though some of its courses approach marble in quality. The stone chiefly used is that classed by Professor Safford as the Maclure limestone, from its large fossil, *Macluria magna*. There are several quarries of this stone in the vicinity of the city. The old quarry near the Chickamauga station, of what was called by the soldiers Chattanooga marble, is in Georgia, and is objectionable on account of having seams in it which cause it to disintegrate by the action of frost.

The pillars of the Union depot are built of this stone, but in additions which were made to the building the material was rejected and that from a local quarry was used. The growth of Chattanooga has been very rapid, and brick has been chiefly employed for fronts, but stone is growing daily more and more important as a material for construction. The pillars and ornamental parts of the court-house are of Knoxville marble, the basement of local stone. The only private residence entirely of stone is of a common limestone from local quarries. This stone is largely used for steps, caps, sills, and other trimmings; it is also much used for foundations. The front of the old post-office, now occupied by the offices of the Cincinnati Southern Railroad Company, is of a yellow sandstone from the line of the Alabama Southern railway. It is soft when first quarried, and easily wrought, but becomes hard on exposure and resists the action of the weather quite well. It is easy to get good foundations in Chattanooga, as limestone usually lies near the surface. There are, however, marshy places that have been filled in, but a few feet of digging reaches the stone. Rolling-mills and blast-furnaces all have solid foundations of stone. The front of the First National bank is built from stone from a local quarry. The quarries from which material for foundations and underpinnings are obtained are situated from 2 to 8 miles from the city. The streets are macadamized with this same material, and there is some stone sidewalk pavement of limestone from local quarries, with curbs of the same material. Piers of all the bridges in the vicinity are constructed of this limestone.

CHELSEA, MASSACHUSETTS.

There are only two buildings in Chelsea entirely of stone (the material used is what is called "mortar-stone"), and two have stone fronts. Those entirely of stone are built of a calcareous rock found in the vicinity. There are two fronts of Cape Ann granite. The foundations and underpinnings are of Cape Ann and Quincy granite. But few of the streets are paved with stone, and the material used is Cape Ann and Quincy granite. The sidewalks are not paved with stone; curbs are of Cape Ann granite.

CHESTER, PENNSYLVANIA.

The only stone exposed in the vicinity of Chester is the gneiss, on which there are several quarries of considerable importance; these quarries furnish almost all the stone for building purposes in the city. In the bridge abutments, however, some Port Deposit gneiss is used in combination with the gneiss quarried in the vicinity. The streets are paved with stone to a limited extent, the material used being cobbles from the Delaware river and rubble from the gneiss quarries in the vicinity. Stone is but little used for sidewalk pavements, brick being ordinarily employed for this purpose. In such sidewalks as are paved with stone the North River blue-stone is used.

CHICAGO, ILLINOIS.

By J. S. F. BATHEN.

LIMESTONE.

The principal stone used in construction in Chicago is the Niagara limestone. The city is supplied with this stone from the various quarries located around Lemont, Cook county. It is brought to the city by means of canal-boats and is unloaded at the docks of the various quarry companies by means of horse or steam-power derricks. It is also brought from Bedford, Indiana.

The material is used as building, dimension, and rubble stone. The first is used in buildings as cut stone, and is of the best quality. The dimension stone is of an inferior quality, yellowish, and generally harder than that used for building purposes, and is used for vault covers, flagging, curbing, and sawed window-sills; roof-coping is made from a variety of this stone varying from $1\frac{1}{2}$ to 3 inches in thickness. This quality of stone frequently contains nodules or layers of flint, which occasion some trouble in working; in other places it assumes a siliceous, even flinty, character. This and its yellowish color do not, however, lessen its value for the above-named purposes.

The stone used for rubble is generally of the second class, although frequently first-class stone too small for building purposes is used. This quality is the only stone used in the city for foundations. The stone when sold to contractors is in large blocks or slabs; these are broken into suitable pieces for cutting by means of hand-churn drills, with which holes 3 or 4 inches in depth and from 4 to 5 inches apart are made in the stone, and the separation is made by use of wedges and feathers. Frequently the stone is stunned here and there by the pressure of the shoulder of the steel wedges. This part, although generally seeming as perfect as the rest of the stone, under atmospheric influences frequently scales or drops off and is condemned, when it is really the fault of the handling.

The Lemont limestone is known to some architects as Joliet limestone, but with no valid reason, as, although there are a number of limestone quarries at Joliet, the stone which supplies Chicago is from Lemont, Cook county, excepting occasionally when cut-stone contracts are let to the state penitentiary, when the stone used there comes from that locality. In letting contracts the stone of any particular quarry is seldom specified, but is referred to as the best quality of Joliet or Lemont limestone; the stone from the different quarries differs very slightly, if at all, that from several of the quarries having a yellowish color. The stone used in the construction of the county part of the court-house is from the lighter-colored stone.

The limestones of Cook county harden upon exposure to the atmosphere for any length of time, and are easiest worked when newly quarried. The stone also becomes slightly yellowish with age, the softer varieties being always the whitest, while those which have a tendency to hardness have generally a slight yellowish or cream color. Any stones which are very hard to work are made much softer by soaking them in water for some time, or even by throwing water on the stone. The Lemont quarries furnished the first stone used in construction in this city, and for the length of time it has been in use seems to stand atmospheric influences and sudden changes of temperature very well, although the stone of some buildings has a tendency to scale off here and there, more especially the stone cut entirely by hand in structures which have been built for some length of time, which may probably be accounted for on the following hypothesis, viz: the stone when given to the workmen to dress, after being drafted is pointed, then axed, and then bush-hammered, the two latter tools weighing from 8 to 12 pounds, and when used probably striking a blow of from 150 to 200 pounds at least, so that the part on which these tools have been used, although seemingly as perfect as the rest of the stone, is probably stunned to

the depth of from one-sixteenth to one-eighth of an inch, and even as deep as one-quarter of an inch, which only requires time and atmospheric influences to cause it to scale or drop off, showing a ragged surface; this theory has been strengthened by the fact that stones in which the face has been sawed by machinery never show the slightest tendency to scale, while those dressed with tooth-ax and bush-hammered generally scale off, though sometimes very slightly. There are in this city about 40 cut-stone yards, of whom about one-half use machinery, as saws and rubbing-beds.

This limestone is never polished. The slightly-yellowish color which the stone takes after years of exposure, and which the poorer varieties, those which are used for vault covers, flagging, and window-sills, have when quarried, are probably caused by sulphide of iron, this brilliant mineral being frequently found in the natural seams and crevices, and between the different strata of stone; light greenish veins are frequently noticed in the stone similar to the veins in white marble.

Quarries of this stone (Lemont limestone) at Bridgeport and along the western city limits produce large quantities of excellent quicklime.

In laying the water and sewer pipes in this part of the city the rock has frequently to be blasted to enable the pipes to be laid to a sufficient depth to protect them from the frost. About two-thirds of the stone used for sidewalks is dressed by means of steam-planers. A large amount of other stone-cutting, such as moldings on cornices, etc., is done by means of machinery.

OOLITIC LIMESTONE.—Blue oolitic limestone from Bedford, and a buff-colored oolitic limestone from Avoca, Lawrence county, Indiana, have been used somewhat in the city within the last few years. When stone was selected for the construction of the city part of the new court-house, the choice was finally awarded to this stone, and its being used in the city hall immediately led to its use in a number of other buildings in the city. The buff oolitic limestone from Avoca is not used so frequently as the blue oolitic from Bedford, in the same county, but this may be accounted for by the fact that the latter was used in the construction of the new city hall. When first built the structures in which either of these two stones (blue or buff oolitic limestone) were used looked very well, but in a short time they became dark and dirty looking, more especially the buildings in the business or commercial part of the city.

SANDSTONE.—The sandstone known by the general name of Waverly sandstone or Ohio freestone is brought to the city from the various quarries at Berea, Columbia, Berlin, Amherst, Waverly, and other places in the state of Ohio, and is used in some of the largest structures in the city. That from Berea and Amherst, of a bluish-gray color, is very largely used in the mills and factories of the city for grindstones. What is known as blue Columbia sandstone, from Columbia, Ohio, although furnishing one of the finest building stones used in the city, is remarkable for the rapidity with which it will become stained with rust (ferric oxide). In sawing the stone into slabs the greatest care is necessary; the sawing of the blocks is generally begun early in the day, so that they can be sawed entirely through without stopping; when taken from under the saw-blades the cut which the saws have made is well washed with clean water. When the stone was first used in the city, or when sawed by parties unacquainted with this peculiarity, the saws were often allowed to remain at rest between the slabs over night; when the slabs were removed and opened up, a stain of iron rust the full length and breadth of the saw blade, and which penetrated the stone from one-third to one-half of an inch, was found, which could only be removed by cutting out the part stained. The laying of a wet chisel or any piece of wet iron on the stone for a few hours is sufficient to cause a similar stain.

Sandstone from Buena Vista, Ohio, has been used in the construction of the Chicago custom-house, and for a number of other buildings in the city. In the custom-house the stone contains large numbers of spots of iron pyrites, resembling those found in Aux Sable stone. They are removed by cutting out the spot with a chisel and then filling the cavity with a mixture of stone dust and liquid shellac, which very soon falls or crumbles out, leaving the original cavity. The stone also stands exposure very poorly, splitting or falling off in large scales or flakes and crumbling away until the original sharp outline is completely lost; the scales which fall off have the peculiarity of being exactly the same on the upper and lower sides; and should the stone be what is known as droved, the scale follows exactly the depressions which the chisel has made. Several attempts have been made to coat or paint the stone with some composition which would protect it from the air, but have not been very successful.

Sandstone from Aux Sable, Grundy county, Illinois, is used somewhat for building purposes. It is of a light grayish-white color, and is very easily dressed—in fact the easiest of any used in the city. It contains large quantities of small scales of mica. The stone contains sometimes iron pyrites; the iron under atmospheric influences, and especially when wet, causes the stone to stain with iron rust wherever the pyrites appear; if the stone is protected from the action of water and air no rust stain appears.

A number of buildings have been constructed in which this stone is used, together with Lemont limestone, as, for instance, caps of limestone and the keystone of Aux Sable sandstone. The contrast afforded by the two stones has a very pleasing effect. Aux Sable stone, when crushed to a fine powder and mixed to a thick dough with water, forms a very good fire-brick lining for furnaces, etc.

Brown or mottled sandstones, from Lake Superior, Michigan, were introduced about 1870. The stone is generally of a rich, deep, reddish-brown color, and may be favorably compared with the brown freestones of Connecticut and

New Jersey. There are, however, some exceptions, the stone of some quarries being very coarse and gritty, and sometimes containing flinty pebbles varying in weight from a few grains to two or three ounces; these are generally very loose, and when struck by the chisel in cutting the stone fly out, leaving a cavity which has to be filled with a mixture of brownstone dust and liquid shellac. The variety containing these pebbles also contains numbers of cavities or pockets filled with clay, iron ore, or a reddish clay, which with water forms a reddish mud. These defects are only found in stone from particular quarries, and can be altogether avoided. The quarries which principally supply the city are those at Marquette and at L'Anse, Michigan; the stone since its introduction has been very generally used and is well liked. A peculiarity of Michigan brown sandstone is the fact that the stone from almost every quarry is spotted here and there with white spots (generally round), varying in size from the size of a small pea to 12 or 18 inches in diameter, though the latter are not very frequent. Various means have been tried to color the spots the same as the rest of the stone, but without success, as whatever is used is soon washed out when exposed to the weather. These spots appear to be of exactly the same composition as the rest of the stone, with the exception that they are uncolored and appear as if they had been touched by a drop or globule of some oil which had prevented the adhering of the coloring matter which had colored the rest of the stone; in this they resemble that which takes place in obtaining oleographs of the different oils, as in Tomlinson's cohesion figures.

Within the last two or three years stones as regularly spotted as possible to obtain have been used as a building stone, which gives the building a mottled red and white appearance, which looks very well. The spots seem to stand as well as the colored parts of the stone.

Brown sandstones from Portland and Middlesex, Connecticut, and from New Jersey, are used in a number of instances but not in large quantities. Those of Michigan are much more used. The cost of working all the sandstones used in Chicago during frost is double what it cost to dress the same stone during warm weather—as the stone which, during warm weather, is a freestone and very easily dressed, under the influence of frost becomes hard, dense, and tough, becoming like lead. Should the weather be very cold the cutting of the stone is entirely discontinued. No matter how dry it may be the advent of frost causes it to become harder and tougher in working. The frost does not appear to have any permanent effect, as on the return of warm weather it again resumes its normal appearance. Machinery is not used at all in the dressing of sandstone excepting to saw it into 4-, 6-, or 8-inch slabs.

GRANITES.—Granites are pretty generally used for ornamental purposes, as for columns, pilasters, monuments, and in one or two instances for sidewalks; but there is only one building constructed entirely of granite in the city—that of the Chamber of Commerce—and one other constructed with granite front. Those principally used are blue or grayish granite from Aberdeen, and a reddish granite or syenite from Peterhead, Aberdeenshire, Scotland; granites largely used for monuments and columns and caps from the Chicago and Wisconsin Granite Company, Waterloo, Jefferson county, Wisconsin; the Westerly Granite Company, Westerly, Rhode Island; from the quarries at Fox island and Hallowell, Maine, and from Henrico county, Virginia, and Moundville, Marquette county, Wisconsin. None of these granites are used in any large quantity, but only here and there, excepting those of Fox island and Hallowell, Maine, which are used in the Court-house and the Chamber of Commerce buildings.

MARBLES.—The marbles of Rutland, Vermont, are largely used in interior work, as mantels, tiles, etc., together with red marbles from Tennessee, Mexican onyx, Belgium black from Brussels, and several marbles from Italy.

All the prominent buildings of Chicago have been erected since the fire of October 9, 1871, and are therefore comparatively new.

In using the stone from the Lemont, Cook county, quarries it is brought to the city during the summer in large quantities, so as to be seasoned before the approach of frost. Thousands of dollars' worth of this stone are lost annually to contractors who have purchased stone which has been quarried too late (or what is known to the trade as greenstone), and which a sudden sharp frost causes to crack and burst in every direction, and making it worthless for any purpose. When the stone is once seasoned no amount of cold has any effect on it. In some instances if the stone is not disturbed till warm weather the cracks appear to close up.

STONE-WORK OF SOME OF THE PROMINENT PUBLIC AND PRIVATE BUILDINGS.—The court-house consists of two parts, the county part and the city part. The county part is chiefly constructed of Lemont limestone. The columns and other granite work are of Fox Island, Maine, granite. In the construction of the city part Bedford, Indiana, oolitic limestone was used; the foundations are of Lemont limestone; columns and other granite work of Fox Island, Maine, granite. The interior ornamental stone-work is chiefly of marble from Rutland, Vermont. Cook County hospital is constructed of Lemont limestone. The custom-house and post-office building is of Buena Vista freestone from the quarry located near the Ohio river, about 100 miles above Cincinnati; there were used 467,445 cubic feet of rough Buena Vista stone; there were used in the pier foundations 48,731 cubic feet of Lemont limestone; foundations of Lemont limestone; the stone used for vault covers and sidewalks is Maine granite. John B. Sherman's residence is of blue sub-Carboniferous sandstone from Columbia, Ohio; foundations of Lemont limestone, with polished columns of granite from Quincy, Massachusetts. The Chamber of Commerce building has a superstructure chiefly of granite; three fronts are of Fox Island, Maine, granite, and the rear wall is of Hallowell granite; foundations of Lemont limestone. The Palmer house is of Amherst, Ohio, sandstone; Lemont

limestone foundations. The Mackin hotel is of Amherst, Ohio, sandstone; foundations of Lemont limestone. The Grand Pacific hotel, on the block bounded by Clark, Jackson, Quincy, and La Salle streets, has three fronts of Amherst, Ohio, stone; foundations of Lemont limestone. The Sherman house, corner of Clark and Randolph streets, is of sandstone from Kankakee, Illinois, which is injuriously affected by reason of the iron pyrites in its composition; foundations of Lemont limestone. The First National bank has marble counters and floor-tiling of red Tennessee and Rutland, Vermont, marble; in the superstructure blue oolitic limestone from Bedford and buff oolitic sandstone from Avoca, Indiana, were used; the foundations are of Lemont limestone; the granite work is of Jonesboro', Maine, red granite. Saint Luke's hospital: blue oolitic limestone from Bedford, Indiana; foundations of Lemont limestone. Saint Paul Universalist church: Lemont limestone. West Side water-works: cut stone is Bedford, Indiana, oolitic limestone; foundations of Lemont limestone. North Side water-works: rock-faced with Lemont limestone; foundations of same material. Academy of Music: Lemont limestone. Northwestern Railway depot: sandstone from a quarry belonging to this road on lake Huron was used; foundations of Lemont limestone. Haverly's theater: Lemont limestone. Depot of Chicago, Rock Island, and Pacific, and Lake Shore and Michigan Southern railroads is rock-faced with Lemont limestone; foundations of same material. The Union League club-house: brown sandstone from Springfield, Massachusetts; the underpinnings are of the Bedford, Indiana, blue oolitic limestone; foundations of Lemont limestone. Central Music hall: Lemont limestone; foundations of same material; the interior ornamentation is of Rutland, Vermont, marble and Mexican onyx; the polished columns are of granite from Red Beach, Maine, and Quincy, Massachusetts. In the Stephen A. Douglas monument the foundation and tomb, the coping, sidewalk, and terrace wall are of Lemont limestone; the pedestals and other granite work of Fox Island, Maine, granite. The armory of First Regiment, I. N. G.: Lemont limestone. Office of the Chicago, Burlington, and Quincy Railroad Company, corner of Franklin and Adams streets: Bedford, Indiana, blue oolitic limestone; foundations of Lemont limestone; sidewalks of the latter material; white Italian statuary marble, black marble from Brussels, Belgium, and red Tennessee marble were used. Calumet club-house: Bedford, Indiana, limestone; foundations, Lemont limestone. Chicago university: rock-faced with Lemont limestone; foundations of the same material. A. G. Byram's residence: Avoca, Indiana, oolitic limestone; foundations of Lemont limestone. M. L. Wilson's residence: Lemont limestone; foundations of same material. Block of residences from 1200 to 1210 State street: Amherst, Ohio, sandstone; foundations of Lemont limestone. Store 302 west Madison street: Buena Vista, Ohio, freestone; foundations of Lemont limestone. Store on Wabash avenue, near Van Buren street: Lemont limestone. Residence, Adams and Lincoln streets: Lemont limestone. Residence corner of Rush and Illinois streets: Berlin, Ohio, sandstone; foundations of Lemont limestone. Wickerson residence: Amherst, Ohio, sandstone; foundations of Lemont limestone. Residence, 549 and 551 west Van Buren street: Lemont limestone and granite from Peterhead, Aberdeenshire, Scotland; foundations of Lemont limestone. Residence, Adams street, near Lincoln street: Lemont limestone. Williams building, Wabash avenue and Monroe street, Amherst, Ohio, sandstone; foundations of Lemont limestone. Taylor building, 146 Monroe street: Bedford, Indiana, oolitic limestone; foundations of Lemont limestone. Adams building, Adams street and Wabash avenue: Amherst, Ohio, sandstone; foundations of Lemont limestone. Residence of C. P. Libby: brown sandstone from Marquette, Michigan; foundations of Lemont limestone. Residence of W. F. Storey, *Chicago Times*, in process of construction: blue marble, Pittsford, Vermont; foundations of Lemont limestone. Boise block, northeast corner of State and Madison streets: partly of Lake Superior brownstone and partly of stone from the bed of Oswego river, New York; the two kinds of brown sandstone from these localities, so widely distant from each other, are so much alike that they are used together indiscriminately; they are both of Potsdam age; foundations of Lemont limestone. B. P. Moulton's residence, Nineteenth street and Prairie avenue: brown sandstone from Middlesex, Connecticut; foundations of Lemont limestone. Potter Palmer's residence: ashlar of brownstone from Portland, Connecticut, and granite from Marquette county, Wisconsin; trimmings of Amherst, Ohio, sandstone; underpinnings of limestone from Trinity bay, Canada; foundations of Lemont limestone. Honoré block: Lemont limestone; Howland block: Cleveland, Ohio, sandstone; foundations of Lemont limestone. Merchants' building, northwest corner of La Salle and Washington streets: Buena Vista, Ohio, stone; foundations of Lemont limestone. Dore block: Buena Vista, Ohio, sandstone; foundations of Lemont limestone. Reid block: Lemont limestone. Union building, southwest corner of La Salle and Washington streets: sandstone from Au Sable, Grundy county, Illinois; foundations of Lemont limestone. Speed block, on Dearborn street, between Madison and Washington streets: Bedford, Indiana, oolitic limestone; foundations of Lemont limestone. Booksellers' row: Lemont limestone. Montauk block: Bedford, Indiana, oolitic limestone; foundations of Lemont limestone. Grannis block, Dearborn, between Washington and Madison streets: Bedford, Indiana, oolitic limestone; foundations of Lemont limestone; columns of gray granite from Quincy, Massachusetts, and red granite from Peterhead, Aberdeenshire, Scotland. Borden block, northwest corner of Dearborn and Randolph streets: Berlin, Ohio, sub-Carboniferous sandstone; foundations of Lemont limestone. Ryerson building, corner of Washington avenue and Adams street: Bedford, Indiana, oolitic limestone; foundations of Lemont limestone. Schufeldt residence, Dearborn street and Lincoln park: green serpentine from Chester county, Pennsylvania; foundations of Lemont limestone. This is the only building in Chicago constructed of Chester county, Pennsylvania, serpentine.

CINCINNATI, OHIO.

Cincinnati is built on ground of the great limestone formation which takes its name from this city, and which is sufficiently durable for foundations when kept below the surface of the earth. In some places in the city the ground is unfavorable to heavy building, as the shales in the hill slopes give way under heavy pressure. For the better class of stone construction sandstone from Portsmouth and the Amherst and Berea quarries, and limestone from Dayton from different points in Indiana, and from the home quarries, and granite from Maine and from Missouri are used. For foundations and underpinnings, beside the limestone quarried in the vicinity, some limestone from Dayton and from points in Indiana, and freestone from the vicinity of Portsmouth, are used. The abutments of bridges over the Ohio river are built of limestone from the home quarries and from Dayton, from points in Indiana, and sandstone from the vicinity of Portsmouth. The streets are largely paved with cobble-stone, but many of the streets and roadways are macadamized with the native limestone. There is considerable stone sidewalk pavement, and the material used for this purpose is the freestone from the vicinity of Portsmouth; also, to a limited extent, limestone from the home quarries and from Dayton, and of late years the remarkably even-bedded limestone of the Helderberg formation from Greenfield, in Highland county, has been largely used. The following are some of the principal structures in Cincinnati, with the stones used in their construction: In the custom-house, limestone of Niagara age and granite from Missouri and from Vinal Haven, Knox county, Maine, were used; in Pike's opera house, the Gibson house, and Shillito's block, freestone from Scioto county was used; in the Sinton building, Trust Company's bank, and Johnson's building, freestone from Rockville, Adams county, was used.

CLEVELAND, OHIO.

Cleveland is situated within easy reach of all the celebrated quarries of the Waverly sandstone in northern Ohio, and nearly all of its stone construction is of this material. The Amherst sandstone is used almost exclusively for the superstructure of stone buildings. The Euclid blue-stone has not been used in any important structures. In the construction of the city hall, sandstone from Independence, Cuyahoga county, was used; Beckman's buildings, Exchange buildings, hotel Madison, Bronson's block, and the court-house, are of Berea stone. The soldiers' monument is of granite from Woodbury, Washington county, Vermont. The Amherst stone is deemed here the best for superstructures and trimmings of buildings; the Berea stone best for bridge-building purposes; the east Cleveland building stone best for foundations and underpinnings; the Euclid blue-stone best for sidewalk paving; the Medina sandstone, from Medina, New York, is used in a few structures; foundations and underpinnings are of local sandstones. The streets are largely paved with stone, and the material used for this purpose is the Medina sandstone. The sidewalks are nearly all paved with stone, and the material used is blue-stone from Euclid and Newburgh; also to some extent sandstone from Berea. The stone commonly used for curbstones is the Medina sandstone, while bridge piers and abutments are mostly built of Berea sandstone. The stone used in the construction of the Cleveland viaduct is from the Berea quarries.

COLUMBUS, OHIO.

Columbus is built mostly on ground made by the glacial drift, which covers a considerable portion of the surrounding country. The greater portion of the site of the city is on ground well elevated above the Scioto river, affording facilities for drainage, and the drift formation furnishes cobble-stones for street pavements and gravel for roadways. That portion of the site, however, which lies west of the Scioto river is on a low, alluvial bottom, but little elevated above the surface of the river, and protected by levees which prevent its inundation when the waters of the river are high. In the extreme western portion of the city limits the Corniferous limestone forms a rather abrupt bluff, and on it are located extensive quarries, where most of the material used for all building purposes in Columbus is obtained. This material was used in the construction of the Ohio state-house, and in the colonnade surrounding the building the columns are constructed of blocks from a course of this limestone which comes from near the bottom of the ledge. The walls of the Ohio state prison are also of this stone. The sandstone from the Waverly formation is used to some extent, and the material is obtained at Berea, near Portsmouth, Black Lick, and Reynoldsburg. The Dayton limestone of Niagara age is used in a few instances, chiefly for trimmings. Saint Joseph's cathedral is built of stone from the Waverly conglomerate, quarried near Lancaster, and some of the material obtained from the Newark quarries is also used. It is worthy of remark here that there are three formations, the exposures of which pass north and south within a few miles of Columbus, all being important sources of building material. Beginning at the east, appears the Waverly conglomerate, next westward the lower Waverly. There is then an interval of several miles of Hudson shales, after which, immediately west of Columbus, the great ledge of Corniferous limestone is exposed, of good quality for general building purposes, and readily accessible to the city. Among the other prominent stone structures in Columbus are the Ohio blind asylum, built of Waverly sandstone quarried near Reynoldsburg, 10 miles east of Columbus; Trinity church and the Kelly residence are of Waverly sandstone from Piketon, Pike county; First National Bank building, McCune block, and Nuthoff block are of Waverly freestone from Rush township, 12 miles from Portsmouth; and the basement and trimmings of the Ohio state university are of Amherst freestone.

CONCORD, NEW HAMPSHIRE.

The seven stone buildings in Concord are constructed of the well-known Concord granite, the quarries of which in the vicinity of the city furnish nearly all the material for stone construction at this place. All the buildings erected of stone in Concord and in Nashua are in excellent condition—no discoloration or decomposition, though the joints in the Concord quarries carry a slight discoloration down to the lowest depth. The substratum is occasionally rock, but usually sand. Brick is the most common material used for building purposes in these cities. The fact that stone construction is more expensive than that of brick or wood rules it out of use here, except for some public buildings. The following is a list of the stone structures in Concord: The state-house, state prison, church in West Concord, Ward & Humphrey's storehouse, two dwelling-houses, and Saint Paul's school building. The street in front of the Phoenix block is paved with Concord granite. There is much concrete used for street paving and sidewalks; the curbs are of granite from the native quarries.

CUMBERLAND, MARYLAND.

The only stones used for construction in Cumberland are Medina and Oriskany sandstones, of which there is an abundant supply in the immediate vicinity, and limestone quarried at Iron's mountain, on the old town road, about 3 miles from Cumberland. The chief uses to which stone has been put in the vicinity of Cumberland have been in the construction of canal walls and locks and dams. The Brett's Creek aqueduct, below the town, is also a good specimen of stone masonry, and is constructed of the limestone from Iron's mountain. The Medina or white sandstone is an admirable building stone. It is fine-grained, easily worked, and especially adapted to situations of exposure to the changes of the weather, as it neither scales nor crumbles. One of the finest churches (Presbyterian) is built entirely of this material, which is used in foundations, underpinnings, walls, sills, curbing, street-crossings, steps, and for capping walls which are built of other stone. The Oriskany or yellow sandstone ranks next as an available building stone for use here, and several quarries have been opened within the city limits. This is quite soft and is much more easily worked than the Medina stone, but does not stand exposure so well, and is not as durable. Of it also one of the principal churches, the Episcopal, is built. Where great weight is to be sustained, as in the foundations in the city hall, the Medina or white stone has been preferred; but for underpinnings, walls, window-caps, and for nearly every purpose, the Oriskany stone has been largely employed. Dressed, for stone fronts, it has been used to decided advantage in two of the handsomest residences; and in the Rose Hill cemetery monumental shafts and vaults have been built of it.

But little limestone has been used here as a building material. The stone of which the Chesapeake and Ohio canal locks, etc., are built was procured 3 miles from Cumberland, and is very durable. The iron sandstone, so called, is an iron ore, or rather a ferruginous sandstone, containing about 18 per cent. of metallic iron. This peculiar material has been made use of to a limited degree, notably in an extended wall on Washington street, capped with white sandstone. It is extremely hard, forms a structure of great durability, and is found in the vicinity.

DAVENPORT, IOWA.

Lumber is cheap, and excellent brick may be manufactured in unlimited quantities from the löess which caps the river bluffs. The stone found in the vicinity is either of a very uniform quality or of the fine, compact, non-magnesian character of the purer strata of the Hamilton formation in Iowa; which stone is hard, closely-jointed, and refractory under the hammer, and in part liable to suffer disintegration under atmospheric agencies, chiefly from the action of frost. Stone brought from other localities is a relatively costly material. There are no local circumstances unfavorable to the use of any good building stones, and the rock substratum beneath much of the city is peculiarly suitable for the foundations of heavy structures. There are no docks, wharves, fortifications, or breakwaters, and no stone sewers. There is an iron bridge across the Mississippi at this point, the piers at the Davenport end being of stone. Trinity church is built partly of limestone from the city quarries. The streets are largely macadamized with the local limestone, and a few of the sidewalks are paved with Anamosa and Joliet limestones.

DAYTON, OHIO.

There are small isolated areas of what is called the Dayton limestone, which is of Niagara age, exposed in the vicinity, and it is on this formation that the celebrated Dayton quarries are located. The court-house and bridges over the canal and the Miami river are built of stone from the Dayton quarries. Sandstone from Portsmouth and Berea is used to a considerable extent, chiefly for trimmings. The streets are largely macadamized with limestone from the Dayton quarries, and a few streets are paved with cobble-stones. Many of the sidewalks are paved with local stone.

DENVER, COLORADO.

The Windsor hotel and the Union depot are of rhyolite, the latter trimmed with Morrison sandstone. The Union Pacific freight depot and the Denver and Rio Grande depot are of rhyolite. The only other stone used for building purposes in Denver is sandstone from Cañon City, Manitou, Fort Collins, and Trinidad. The quarries near this place lie at the foot of the mountains to both the north and the south of the city. The stones are white and red sandstone obtained from the lower horizons of the Cretaceous; some of the white sandstones are possibly from the Jura. A light pinkish-gray rhyolite which has broken through the Tertiary strata half-way between Denver and Colorado Springs is a favorite building stone in Denver; it seems to wear well, is easily worked, but will not stand fire. The streets are not paved; a few sidewalks are paved with sandstone flags from Fort Collins; curbs are of the Morrison sandstone. Bridge piers on Cherry creek and Platte are of rhyolite from Castle Rock.

DERBY, CONNECTICUT.

The material chiefly used in Derby for stone construction is the gneiss from Ansonia. Of the twelve stone buildings in the city eleven are of the Ansonia gneiss and one of rubble-stone from Birmingham. There is no other stone used here except a very small amount of North River blue-stone for sidewalk pavements and for curbstones, while the gneiss before mentioned is used to a limited extent for the same purposes. The bridge abutments across the canal and the Naugatuck river are built of the Ansonia gneiss. There are no paved streets. The Ansonia gneiss is a good material for all ordinary purposes of construction, and is the only building stone to be found in the vicinity.

DES MOINES, IOWA.

Most of the building stone heretofore employed is from Earlham, all of which, except a single ledge in the Bear Creek quarry, is regarded as inferior. It is reported by the city engineer that certain stones from the Earlham quarries are durable and strong, while others undistinguishable in appearance disintegrate rapidly. It is probable that the rock is not sufficiently seasoned before using. The quarrymen think that little if any seasoning is required. Wood is a cheaper building material than stone, as the nearest quarries are so far from Des Moines that freights add very materially to the cost. Rubble, which costs one cent per cubic foot in the Earlham quarries, costs 5 cents per cubic foot delivered in Des Moines. Excellent building stones exist in unlimited quantities in Winterset, in Madison county, near Tracy and Pella, in Marion, and at Givin and elsewhere in Mahaska county, at little greater distance from Des Moines than is Earlham. The new state capitol now in process of construction, with the superstructure nearly completed, is the only important public building in the city. The following is a statement of the building stones used in the state capitol, and the number of cubic feet of each kind:

	Cubic feet.
Granite from Grundy and Marion (boulders).....	6,659
Granite, Minnesota.....	3,034
Granite from Iron Mountain, Missouri.....	1,607
Total.....	11,300
Sandstone from Carroll and Sainte Genevieve counties, Missouri.....	284,259
Limestone (dimension).....	172,924
Rubble and concrete.....	70,136
Total.....	527,319

The rubble comes from Bear Creek quarries, $2\frac{1}{2}$ miles north of Earlham; the dimension stone to the ground-line comes from Winterset, Madison county; the limestone dimension, constituting the basement story, comes from Northbend, Johnson county; some limestone used in the interior piers of the basement comes from Anamosa, Jones county, and some used in the interior columns and pillars comes from Lemont, Illinois, the quantity being small. A considerable quantity of limestone from Rock Creek, Van Buren county, was used in building the foundation; but it was found to disintegrate so rapidly under the action of frost that it was afterward removed. It appears from reports of various quarrymen that small quantities of stone from localities not above mentioned have also been used in the construction of the state-house. There are no sewers except temporary drains. A system of sewerage is now in contemplation, and the paving of the streets is deferred until such sewers are completed. There are no wharves; but there are two iron bridges across the Des Moines river, the piers and abutments of which are of limestone, mainly from Earlham. Of the three railway bridges across the Des Moines river, that of the Chicago, Rock Island, and Pacific railroad has piers and abutments constructed mainly from Earlham limestone. The streets are not paved with stone; there is a little sidewalk pavement, of Joliet limestone, with curbs of Joliet, Pella, and Earlham stone.

DUBUQUE, IOWA.

The city is located upon an alluvial terrace and bottom, the materials of which are sufficiently firm to support buildings of any weight; provided care is used in the preparation of the foundations. Lumber is cheap and abundant; bricks are cheap and are the principal material for buildings; but limestone from the local quarries is used exclusively in the construction of sewers. There is a cross-street (Seventeenth street) located in the course of a ravine heading in the high bluffs to the westward, and in order to prevent destructive overflows it has been graded below the ordinary level, paved, and flanked with walls of masonry, so that during freshets the street itself serves as a drainage channel. The Galena limestone from the local quarries was employed exclusively in this work. An extensive artificial embankment for a levee, used for a wharf and utilized as a site for many important buildings, is protected by riprapping, in which the same material is used. The Episcopal church is built partly of limestone quarried near Farley station. The material for the abutments of the railroad bridge across the river was largely obtained from a tunnel in Galena limestone at the Illinois end of the bridge. The building used as a custom-house and post-office is constructed of limestone of the age of the Saint Louis formation quarried at Nauvoo, Illinois. Five per cent. of the street area is paved with the limestone from local quarries, and other streets are macadamized with the same material; except on the main street there is but little sidewalk pavement, and the material used is limestone from Anamosa and Farley, in Iowa, and Joliet, Illinois, and to a very limited extent the blue limestone of Trenton age from quarries 15 miles north of the city, on the Wisconsin side of the river.

EASTON, PENNSYLVANIA.

Easton is situated on moderately uneven ground, portions of the town being located on low ground on the banks of the Lehigh and the Delaware rivers, the junction of which is here, but the greater part is built on ground considerably elevated above the rivers. The surface everywhere offers firm and secure foundations. The limestone quarried in the vicinity is the material used for all ordinary purposes of construction. It is about the lowest limestone in the geological scale within the limits of Pennsylvania, being probably the bottom of the Siluro-Cambrian formation. The brownstone quarries of Triassic age located in New Jersey are readily accessible from here, and are considerably drawn on for building material by Easton. The principal stone buildings are Pardee hall, of Trenton sandstone, with Ohio sandstone trimmings; several churches are also of Trenton sandstone, and the front of the jail is of the same material. The Wyoming blue-stone from near Meshoppen is now being introduced for trimmings. The stone sidewalk pavement is not extensive, and the materials used for this purpose are Wyoming blue-stone, and North River and Lehigh slate. Curbstones are of native limestone.

ELIZABETH, NEW JERSEY.

In the business parts of the city, in the large buildings, brick is mostly used, although there are many of wood; but private residences are almost exclusively frame buildings. Brownstone is used in trimmings and in cellar walls and foundations, but not to so great an extent as brick. Saint John's Protestant Episcopal church is a fine example of brick trimmed with stone. Dark red sandstone was formerly used for grave-stones in the cemetery of this church, and these old stones are beginning to scale off. Several bridges over the river are built of sandstone, but these are small. Of streets opened and graded the total length is 79 miles; of paved streets, 26 miles; rectangular-block pavements, part granite and part trap-rock, 13 miles; the greater part of the trap-rock is from the Hudson County quarries. Of the three stone structures the most prominent is the Westminster Presbyterian church.

ELMIRA, NEW YORK.

The materials used for stone construction in Elmira are, for foundations and underpinnings, sandstone from the local quarries; for the better class of work, sandstone from the local quarries and limestones from Syracuse. The quarries of sandstone in the vicinity supply all the railroad work, except that in which heavy stone is needed, in which case the material comes from Unionville and Waterloo. The streets are not paved with stone, with the exception of two blocks, which are paved with Medina sandstone. But few of the sidewalks are paved with stone; the material used is blue-stone from Trumansburgh.

ERIE, PENNSYLVANIA.

Three stone structures in Erie are constructed of Medina and Amherst sandstone and Sandusky limestone, with one building of marble from Dorset, Vermont. The material for foundations and other rough purposes is a sandstone of the Upper Devonian age quarried in the immediate vicinity, and a sandstone of sub-Carboniferous age quarried at Corry, in Erie county. Sandstone quarried at Leboeuf, in the same county, is used to some extent for foundations and bridge abutments, flagging, caps, and sills. The streets are largely paved with stone, the

material most used for this purpose being the Medina sandstone; rubble is also used to a considerable extent. Sidewalks are but little paved with stone, and the material used is chiefly blue-stone from Euclid, Ohio; the Berea, Ohio, sandstone being also employed to some extent. The material commonly used for curbstones is the Medina sandstone. The stone from the quarries along the lake shore east of Erie, used for foundations, is a rather inferior material, but as it can be obtained at small expense, it is employed quite extensively for the underground portions of foundations; but some of it is not capable of withstanding the action of frost.

EVANSVILLE, INDIANA.

In the western part of the city the ground is unfavorable to building, as quicksand underlies the surface; but in the eastern and central parts this unfavorable condition does not exist. There is but one building entirely of stone, but ninety-nine buildings have stone fronts. The materials used in these buildings are the Bedford and Ellettsville limestones. Limestone of the sub-Carboniferous age, from the vicinity of Spencer, Owen county, was employed in the construction of the custom-house. The foundations and underpinnings are of limestone quarried in the vicinity of Evansville. The streets are but little paved with stone, and the material is the limestone from the various points in Vanderburgh county, in which the city is situated. The sidewalks of the business streets are usually paved with the Bedford limestone, with crossings of limestone from North Vernon, Indiana. Curbs are of Portsmouth, Ohio, sandstone, as in the case of most of the other important towns on the Ohio river; the wharves here are constructed of cobble-stones on the banks of the river.

FALL RIVER, MASSACHUSETTS.

About 40 structures in Fall River, mostly mills, are of stone, the material used being granite from local quarries. Among the buildings of Fall River granite is the city hall. The new post-office and custom-house building is of granite in part from Westerly, Rhode Island. The mills before spoken of are, comparatively speaking, handsome structures, and the material of which they are built was quarried by the builder as it was needed in their construction. Some of the material in these structures is surface rock taken from the fields in the vicinity and from the outcrops of granite ledges. A portion of one of the streets is paved with granite blocks from the Fall River Granite Company's quarries in Freetown, and some streets are paved with cobble-stone from the drift in the vicinity. A few of the sidewalks in the older portions of the city are paved with the North River flags, and the curbstones are granite from Fall River quarries.

FITCHBURG, MASSACHUSETTS.

There are only two buildings in Fitchburg entirely of stone; the court-house and the Episcopal church are both built of granite from Fitzwilliam, New Hampshire. There are two stone fronts built of granite from the local quarries. The Fitchburg granite comes from Rollstone hill, about half a mile distant from the railroad station. Foundations and underpinnings are of Fitchburg and Fitzwilliam granite. There is but little stone street pavement, and the material used is the Fitchburg granite; sidewalks are not paved with stone, and curbs are of granite from local quarries.

FORT WAYNE, INDIANA.

There are but five stone buildings reported in the city. Limestone from White House, Ohio, is perhaps next in importance for foundations to that of the Wabash, Indiana. Limestone from the state is used to some extent for foundations of small structures. Stone is used to a considerable extent for paving sidewalks, though brick is used to a much greater extent. The Amherst, Ohio, sandstone was formerly used almost exclusively for the different purposes for which sandstone is commonly employed in this city—monument bases, caps, sills, and trimmings in general—but the Buena Vista sandstone is used almost exclusively now, because it is obtained here at a little lower price. The sandstone from Stony Point, Michigan, is considered by some builders to be equal in quality to the Amherst stone, but its brown color is objectionable to some. Foundations and underpinnings are of the Wabash limestone, and to a limited extent, some stone from Stony Point. The streets are macadamized with Wabash limestone, and a few of the sidewalks are paved with sandstone from Berea, Ohio, and limestone from Joliet, Illinois; the curbs are of the Joliet limestone; bridge abutments are built principally of sandstone from Stony Point, Michigan.

GALVESTON, TEXAS.

A few foundations in this city are built of stone brought in ships as ballast from various parts of the world, and all that has thus far been employed proves substantial and durable. The city is built on a sand-bank, and the usual manner of preparing the foundations of the largest buildings is simply to remove the top soil, which is only a few inches thick, and, provided there is no danger of the sand wasting from under, every inch deeper is

considered money thrown away. In sinking an artesian well recently silt was struck at 720 feet; all above this was sand, shell, and clay, or beds of silt in varying thicknesses. The United States government is using for the jetties the calcareous sandstone from a quarry 9 miles from Brenham, on the Gulf, Colorado, and Santa Fé railroad; also limestone from points on the East Texas railway. Both of the above stones make reliable masonry, and they are used on the railroad for bridge abutments and piers; they are rather porous. The ship ballast used so much for foundations and underpinnings comes chiefly from the northern United States, from Canada, and from Europe. There are but 20 square yards of stone street pavement in the city, and this is of cobble-stone brought as ship ballast. A few sidewalks are paved with sandstone, blue limestone, and granite from Connecticut, and from Germany and England.

GLOUCESTER, MASSACHUSETTS.

The six structures entirely of stone and the four stone fronts in this city are built of Gloucester granite. The only stone used for any purpose, with the exception of a few perches of lintel stone from New Brunswick, is granite from the quarries within the city limits. The streets are but little paved with stone, the material being the Gloucester granite; the sidewalks are not paved with stone, and there are some curbs of the granite from the local quarries.

HARRISBURG, PENNSYLVANIA.

Brown sandstone of the Triassic age is largely used in Harrisburg. Some of it comes from the Connecticut valley and some from Goldsboro', York county, but at present it is nearly all obtained from Hummelstown, Dauphin county, which is but a short distance east of Harrisburg. The climate here is rather severe on the brownstone, from whatever locality it comes. In buildings of this material it was noticed that blocks at the base, where more subject to sudden alternations of dampness and frost, are scaling off in thin flakes, while the stone higher in the wall remains unaffected. The stone-work about the base of the Pennsylvania State Capitol building is of brownstone from Goldsboro', York county, the superstructure being of brick; the brownstone is scaling off rapidly, due probably in a great measure to unskillful handling, as well as to the effects of damp and frosty atmosphere. Many of the stones are set up edgewise, instead of being laid as in the quarry. The Hummelstown brownstone is steadily increasing in use here. Front street, facing the Susquehanna river, seems to be the locality in this city most severe on building stones; the street is more exposed to rapid alternations of damp and cold weather than the other parts of the city. The material mostly used for the rougher building purposes, such as cellar walls and foundations, is the blue magnesian limestone quarried in the immediate vicinity, and most of the stone buildings are of this material. It is quite durable, the weather having apparently no effect on it, except to fade it to a light color; it is hard and brittle, and not readily susceptible of a fine dressing. Several private residences are built of blocks of this limestone of irregular shape firmly cemented together, and the effect is very pleasing. One of these, the house of Hon. Simon Cameron, was built by the founder of Harrisburg a century ago. In trimmings, curbing and steps, the Amherst, Ohio, sandstone is used in a few instances, but its use here is of recent date; the material as yet shows no sign of being affected by the elements. One building, the Dauphin County prison, is built principally of a gray, conglomeratic sandstone quarried several miles south of Harrisburg, near the Susquehanna river. The building was constructed in 1840, and the stone in the walls has been redressed several times since its construction; this is made necessary by the constant scaling off of the dressed surface in thin flakes. It was thought to be a most substantial material at first, but its vulnerable character is now so generally recognized that it is no longer quarried for building purposes. For underpinnings, steps, base courses, caps, and sills, Conewago granite, a dolerite quarried from the trap dikes which cut the Triassic formation at various places, is used to a considerable extent. The quarries which supply Harrisburg with this stone are principally those at Collins station, Lancaster county, and York Haven, York county. The material is practically indestructible, but its somber, dead color restricts it to uses in which fine effect is not desired. The abutments of bridges crossing the Susquehanna river here are constructed of the magnesian limestone quarried at Bridgeport, opposite Harrisburg; the abutments are repaired in places with patches of Hummelstown brownstone. The Dauphin County soldiers' monument is built of the trap-rock called Conewago granite; the superstructure is of Maryland marble, and the figure surmounting the column is of Carrara (Italian) marble. For curbs, base courses, caps, sills, etc., Conewago granite and Montgomery county and Maryland marbles are all used to a considerable extent. One new house is being trimmed with the Wyoming blue-stone, a handsome, fine-grained and uniform, rather light blue sandstone from Meshoppen, Wyoming county. The new post-office building, in course of construction, has a foundation of Conewago granite from Collins station, Lancaster county; the exposed part of the foundation is of Old Dominion granite, a biotite granite quarried near Richmond, Virginia, and a superstructure of granite from Bluehill, Maine; the latter two materials resemble each other very much. The streets are but little paved with stone, and that most used for this purpose is cobble-stone from the Susquehanna river. There is but little sidewalk paving; the material used is the North River blue-stone, well known through the eastern states as a paving material. For roofing, Peach Bottom slate from the slate district in York county and the adjoining district of Maryland, is most extensively used, and slate from Lehigh and Northampton counties is also used for the same purpose.

HARTFORD, CONNECTICUT.

As the celebrated quarries of brownstone in the Connecticut valley are of easy access to Hartford, this is the source from which the city draws most of its material for stone construction. A few buildings are constructed of marble from East Canaan, and granite from Westerly, Rhode Island, is employed to a considerable extent; and in one building granite from Glastonbury is used. There are three or four stone bridges across Park river, and a retaining-wall about 500 feet in length and 20 feet high along the same river, all of Portland brown sandstone. The state capitol is by far the most important of the marble structures, the others being simply the fronts of three blocks of buildings. Many blocks in the walls of the state-house are of crumbly material; flakes can be taken from them and rubbed to powder between the fingers. Limestone from Glens Falls, New York, is used in some of the inside stone-work of the state-house. In the United States custom-house and post-office granite from Saint George, Maine, was used. Light gray granite from Hallowell, Maine, was used in the construction of the monument to General Stedman. The streets are nearly all telfordized or macadamized with trap from quarries immediately southwest of Hartford. Sidewalks are largely paved with the North River blue-stone, and Bolton flagging-stone is used to some extent. The curbstones are of gneiss from quarries in Glastonbury, and of North River blue-stone.

HAVERHILL, MASSACHUSETTS.

The 15 buildings enumerated in Haverhill as having stone fronts are merely faced with Maine or New Hampshire granite for the first one or two lower stories. The one building constructed entirely of stone is a fine, large summer residence of an inferior quality of granite taken from the hill upon which the house stands. Foundations and underpinnings are of Cape Ann and Maine granite. There is a little stone street pavement of Cape Ann granite; the sidewalks are not paved with stone; curbs are of Cape Ann granite. The piers of the bridge across the Merrimack river are of Maine granite.

INDIANAPOLIS, INDIANA.

The stone most used in Indianapolis for the ordinary purposes of construction is the limestone from Indiana quarries. The sub-Carboniferous sandstone from near Portsmouth, Ohio, has been employed to a considerable extent. The Niagara limestones from Decatur and the neighboring counties may be used as ashlar in the construction of the walls without much dressing, causing a very considerable saving in mason work.

The Putnamville siliceous limestone lies in even courses from 4 inches to 2 feet in thickness. It is a silicate of lime, and resists the action of the elements admirably. Specimens exposed to extreme variations of temperature for forty-six years still retain the chisel marks as fresh as when first dressed; and a door-step of a college resisted the daily foot-wear for fifty years, with wear of less than one-sixteenth of an inch.

The oolitic limestone when soiled is quickly made bright and clean by the inexpensive process of brushing with steel or wire brushes. True, smooth, highly-colored stone tiles of the best quality are made here of this material. The piers and abutments of bridges and cell walls of jails are largely constructed of Niagara limestone from Decatur county, and Indiana oolitic limestone is used for the same purpose. The approaches to the tunnel under the railroads on Illinois street are built of Niagara limestone from Decatur county. Siliceous limestone of the sub-Carboniferous period, quarried at Putnamville, was used for foundations, curbs, and paving flags some years ago, and has shown valuable qualities for resisting the action of weather, time, and fire. Its use was discontinued by reason of a more easy access to other quarries. The new state-house, when completed, will contain 410,000 cubic feet of Niagara limestone and 520,000 cubic feet of oolitic limestone. The foundations and underpinnings are of the Niagara and Devonian limestones quarried in Decatur and Jennings counties, and the sub-Carboniferous from Owen county is used to a limited extent. Granite from Hurricane island, Maine, was employed to some extent in the stone-work of the capitol, and limestone from North Vernon, Jennings county, was used in the construction of the Indianapolis arsenal. In such streets as are paved the cobble-stones are used exclusively. Sidewalks are largely paved on the business streets with Niagara limestone from Decatur county, and artificial cement is used to a limited extent. Curbstones are of Decatur County limestone.

ITHACA, NEW YORK.

About the only material used for stone construction in Ithaca is the sandstone quarried in the immediate vicinity. Cornell University buildings are of stone from quarries near them; some in fact are within the grounds of the university. The trimmings are of Berea, Ohio, sandstone, Lockport limestone, and Medina sandstone, from Albion. The streets are not paved with stone; the sidewalks are largely paved with blue-stone from quarries near the city, with curbstones of the same material. The total amount of stone construction in Ithaca is small, only 15 buildings being reported as constructed of this material.

KEOKUK, IOWA.

The stone buildings thus far erected are among the largest of the city. The sandstone of Sonora, Illinois appears to be an excellent and durable building stone. Quarries of similar material are found on the Iowa side of the Mississippi, near the mouth of the Des Moines river, and also 5 or 6 miles above Keokuk, which have been operated only a short time. The abutments and piers of the railway bridge across the Mississippi are of arenaceous limestone from Sonora, Illinois. The stone used in the construction of the Des Moines Rapids canal is mainly from the same locality, though in part from temporary quarries of similar stone near Nashville, Iowa. The stones for foundations and underpinnings and the ruder purposes generally is limestone of sub-Carboniferous age quarried within the city limits; this material was used in the construction of the opera house (foundations) and the Keokuk Elevator Company's elevator. The streets are not paved, but some of them are macadamized with the local stone. A few of the sidewalks are paved with limestone from within the city limits.

KINGSTON, NEW YORK.

Of the stone buildings 34 are old dwelling-houses. These are generally $1\frac{1}{2}$ stories high, and are built of surface rock, mostly limestone and graywacke; some few are stuccoed. As good examples of durability we may mention the old Senate house, built by Wessells & Tenbrook in 1676. The Hasbrouck and Bruyn houses are also very old. Hard surface stone used in these buildings have suffered scarcely any change such as weathering might induce. Of the more prominent buildings the Ulster County court-house was erected in 1818, and still looks bright and clean; the First Reformed church is the largest and most costly stone building in the city; it is built of a dark slate-colored grit or graywacke found in the neighborhood. The stone is thinly-bedded, but looks well. The Second Reformed Church building is of limestone; the material is much disfigured by the brown and dirt-colored stains due to the weathering of the clay seams of the mass. These stains reach in all directions through the stone. The superiority of the surface stones which appear in the old houses is evident at a glance. This limestone came from quarries near the town. Ohio sandstone has been employed in the trimmings of the new city hall; otherwise it has been scarcely used. The lower portions of the city are of brick. The aggregate length of paved streets, according to ex-Mayor James T. Lindsley, is less than one mile, and is confined to three streets. In front of two blocks the street is paved with granite blocks. For the most part foundations and underpinnings are from the blue-stone flag quarries at Kingston and Hurley, Ulster county. Some of this work, however, is of limestone, blue rock, and slate quarried within the city limits. The sidewalks are largely paved with stone, there being about 60 miles of flagging of blue-stone from quarries at Kingston and Hurley. Curbstones are of the same material. The large amount of stone sidewalk paving is due to the close proximity of the city to the most celebrated flag-quarry region in the country.

LA FAYETTE, INDIANA.

Stone used for building purposes in this city is almost exclusively limestone from the quarries of Decatur, Lawrence, and Monroe counties. It is used quite extensively for trimmings; its light color gives a fine architectural effect when used in connection with brick. The streets are not paved with stone, but the gutters are laid with bowlders gathered in the vicinity. A few of the sidewalks are paved with limestone from Greensburg, with curbs of the same material.

LANCASTER, PENNSYLVANIA.

A large percentage of the buildings in Lancaster have considerable stone in their composition, in the way of base courses, caps, sills, etc. Stone is used to bring the base of the houses to a level on the uneven ground, and brownstone from Hummelstown, from Ephrata, in Lancaster county, and from other points is used for the purposes mentioned. Connecticut brownstone is employed in a few instances. The Conewago granite, from the Kellar quarry near Collins station, is frequently used for base courses. It is apparently invulnerable to the attacks of the elements. Amherst, Ohio, stone is used to some extent for base courses and trimmings.

Blue-stone from Meshoppen and other points in Wyoming county is being introduced for trimmings and is very highly esteemed. Montgomery County marble is well adapted to the construction of fronts, base courses, caps, and sills, for which purposes it is much employed in Lancaster.

In the cemeteries the New England marble is employed to a considerable extent, also Montgomery County marble; granite from the New England states and from Maryland, and some Scotch granite; Hummelstown and Connecticut brownstone to a small extent; and for lot inclosures, Conewago granite. Some houses in the city are trimmed with white marble from Sutherland Falls, Vermont. For foundations and underpinnings the material ordinarily employed is magnesian limestone, which is quarried in the vicinity, and the old houses in the city are built of the same material. The streets are largely paved with stone, the greater part, however, being simply macadamized with the limestone quarried in the vicinity. The public square and portions of other streets are

paved with granite blocks from cape Ann, Massachusetts. The sidewalks are largely paved with stone, the material chiefly used being Wyoming blue-stone from near Meshoppen, Pennsylvania. The North River blue-stone is also used to some extent for sidewalk paving. Lehigh County slate is used for sidewalk paving. Bridge abutments, culverts, and embankment walls are constructed of Siluro-Cambrian limestone quarried in the vicinity. The soldiers' monument is built of white marble, the base being of New England granite. The Peach Bottom slate is highly esteemed for roofing, and the Lehigh County slate is also extensively used for the same purpose.

LAWRENCE, MASSACHUSETTS.

The only important stone buildings in Lawrence are two large Catholic churches, one Congregational church, and a large prison. Stone has thus far been used to a very limited extent as material for construction in Lawrence, except as underpinning. The factories and tenement houses are almost all of brick, while the suburban residences are of wood. The same may be said of Lowell and Haverhill. The material for foundations and underpinnings is granite from New Hampshire and from cape Ann and Westford, Massachusetts. The streets are largely paved with Cape Ann and Westford granite. A few of the sidewalks are paved with Cape Ann granite, and curbs are of the same material.

LEAVENWORTH, KANSAS.

The limestone chiefly used in this city is from a 14-foot bed occurring about 20 feet above the ordinary water-mark in the river; it is of Upper Carboniferous age, and corresponds to No. 112 of section U. C. M. (See p. 94 of Part II, *Missouri Geological Report of 1872*.) Four feet above is another limestone (No. 115, Missouri section) which has been extensively used at Leavenworth city for sidewalks and foundations, but it often shows many sand tracts. Other rocks used largely at this city are from Junction City and Cottonwood Falls, Kansas. Cottonwood limestone was used in the construction of the court-house and the Missouri Valley Life Insurance building. The columns of the custom-house are of red granite from Red Beach, Maine. The riverside quarries at Leavenworth have been abandoned on account of the cost of stripping; at the present quarries there are from 4 to 8 feet stripping of earth and shales. Foundations are all rubble-stone from local quarries and from Fort Scott. The streets are largely macadamized with the limestone from local quarries; the sidewalks, however, are chiefly paved with brick, and to a limited extent with limestone from near Fort Scott. The only building constructed entirely of stone in the city is built of the local limestones.

LOCKPORT, NEW YORK.

Within the limits of this city there are extensive quarries of both sandstone and limestone, and they furnish all the material used for stone construction. The sandstone quarries are located on a ledge of Medina sandstone age, and by far the larger number of stone buildings are constructed of this material. It is used to some extent also for sidewalk paving and street-paving blocks. The greater part of the material for stone construction in Buffalo is also brought from these quarries. The limestone quarries are located on a ledge of Niagara age and on the same horizon as that over which the cataract of Niagara flows.

The foundations and underpinnings are usually constructed of limestone from the local quarries, but the Medina sandstone is also used for these purposes to a limited extent. The streets are but little paved with stone, there being only a quarter of a mile of the Medina block pavement. There is but little stone sidewalk pavement, the material used for sidewalks being planks; in such sidewalks as are paved with stone the Medina sandstone is the material used. Five double locks on the Erie canal are of limestone from local quarries and from the canal excavation.

LOGANSPORT, INDIANA.

The limestone that has been used so extensively in this city for entire buildings is taken from the quarries 3 miles below the city, on the Wabash river. The color of the stone is gray and quite uniform, and some of the finest structures in the city have been built of it. Oolitic limestone from southern Indiana is used extensively for trimmings; that from Stinesville is perhaps used most extensively at present for this purpose. The Amherst and Berea sandstones of northern Ohio were used to a limited extent for the same purposes. The Buena Vista stone of sub-Carboniferous age, quarried in southern Ohio, has been used for ashlar. The limestone quarried in the vicinity of the city furnishes material for foundations and underpinnings. The sidewalks are largely paved with limestone from southern Indiana and sandstone from Berea, Ohio; the curbs are of native limestone. The material used for bridge abutments and piers is sandstone from Williamsport and Attica, and limestone from Logansport, and the oolitic limestone from the southern part of the state.

LOUISVILLE, KENTUCKY.

The rock exposed in the immediate vicinity of Louisville is the sub-Carboniferous limestone, which is of the same age as the Indiana *oolitic* limestones; hence the city has a good local supply of building stone which answers well for all ordinary purposes of construction, and extensive use is made of this supply. For the finer purposes of construction the Indiana *oolitic* limestones are extensively used, and as the city is situated on the Ohio river it has ready access to the Buena Vista and other sandstone quarries near Portsmouth, Ohio, and much of this stone is used. The Bowling Green, Kentucky, limestone has also been very extensively employed. This limestone, like that of the local quarries, is of sub-Carboniferous age. The Louisville limestone, however, although taking good rank as far as durability is concerned, is hard and sometimes flinty, and is much more expensive to dress than the sub-Carboniferous limestones usually are where exposed in other places, and this fact confines its use to the ruder purposes. The streets of Louisville are largely paved with limestone from the local quarries, and a few of the sidewalks are paved with Bowling Green limestone, with curbs of the same material. The abutments of the railroad bridge over the Ohio were built of Utica, Indiana, stone. The wharf is constructed of cobble-stones; the locks and walls of the Louisville canal are built of the local limestone; it was also used in the construction of the custom-house and the city work-house. Limestone of sub-Carboniferous age, quarried near West Salem, Washington county, Indiana, was used in the construction of the Galt house and the city hall. Sandstone from the vicinity of Cannelton, Perry county, Indiana, was used in the construction of the water-works and locks.

LOWELL, MASSACHUSETTS.

There is quite a number of small factories, barns, and dwelling-houses in Lowell constructed of the blue mortar-stone taken from quarries in the immediate vicinity of the city. This material is considered more durable than the very micaceous granite; the disadvantage in using it for building purposes lies in the great difficulty of quarrying blocks of given dimensions. The Concord granite is preferred, owing to the small amount of iron in its composition. There is a very micaceous gneiss quarried in the immediate vicinity somewhat used for building purposes, but it is liable to rust on account of the quantity of iron in its composition, and it also has a tendency to crumble when subjected to the action of intense heat.

The following are the different building stones most used in the better class of stone construction in this city: Granite from Concord, New Hampshire; mortar-stone, quarried in the immediate vicinity; marble from Rutland, Vermont; granite from Westford, Massachusetts; granite quarried in the vicinity of the city; foundations and underpinnings are of granite from Concord, New Hampshire, Westford granite, and the various stones quarried in the vicinity of Lowell. A very large bridge is being constructed across the Lowell railroad of stone quarried in Westford, Massachusetts; the Episcopal church and Saint Patrick's church in Lowell are built of stone taken from Livingston quarry, within the city limits. The streets are largely paved with Westford and Concord granites. There is some stone sidewalk paving of Westford granite, with curbstones of the same material.

MANCHESTER, NEW HAMPSHIRE.

A very few stone buildings in Manchester are constructed of granite quarried in the immediate vicinity. The materials usually employed in construction here are brick and wood. In the construction of the Amoskeag dam 50,000 cubic yards of granite were used. The walls of a canal a mile in length and the piers of six bridges across the Merrimack river are built of granite from Bedford. These quarries are not now operated. The soldiers' monument was built of Concord granite. Foundations and underpinnings are of granite and gneiss quarried in the vicinity, from the lake gneiss formation, and the granite occurring in masses in the gneiss. There is a mile of street pavement of Hookset granite in blocks a foot square. There is very little stone sidewalk pavement of gneiss from the immediate vicinity. The sidewalk in front of the Merchants' exchange is paved with Potsdam sandstone. The curbs are of native granite and gneiss.

MIDDLETOWN, CONNECTICUT.

On account of the close proximity of the Portland quarries, which are on the opposite side of the river from Middletown, almost all the stone used in this city is obtained from them. There are very few stone buildings, however, by far the largest use of the stone being for foundations and underpinnings. The sidewalks for the most part are from 3 to 4 feet apart, and they as well as the curbstones are of a kind of gneiss from the Haddam and Maromas quarries; this material splits with rather a rough surface. In the principal business streets large flags of North River blue-stone are considerably used, and in many spots slabs of sandstone occur, which, however, do not stand well under foot-wear. In buildings the dressed sandstone scales off badly when set on edge; when laid as in the natural bed this defect is not apparent. A large railroad bridge across the Connecticut river, at Middletown, has its piers and abutments built of a granitic rock taken from the quarry, worked only for this purpose, a short distance up the river on the east side. The streets are not paved.

MEMPHIS, TENNESSEE.

There are but two buildings in Memphis constructed entirely of stone, the custom-house and the post-office. The first is built of marble from Knoxville, Tennessee; the second, of granite from near Iron Mountain, Iron county, Missouri. Eight buildings are enumerated as having stone fronts, one of which is built of sandstone from Alabama, six of limestone from Alabama and Kentucky, and one of freestone from near Portsmouth, Ohio. Foundations and underpinnings are chiefly of brick, but there are some of limestone from Alabama and Kentucky. Limestone is used in wharf paving and breakwater of riprap walls, of which there is now paved an area of 2,700 by 250 feet—equal to about 75,000 square yards. The arched culvert bridges and abutments are constructed chiefly of brick, and one arch culvert is built of limestone from Alabama.

The sewer system, built in 1880-'81, is constructed for the most part of vitrified clay pipe from 6 to 15 inches in diameter, the main outlet being of cast-iron and brick 20 inches in diameter. Granite and sandstone quarried in the vicinity of Little Rock, Arkansas, are used for building purposes. Sandstone and limestone from Arkansas and Missouri, and limestone from Illinois, Kentucky, Tennessee, and Alabama are all employed in construction here. Most of the quarries are accessible by water and by railroad, and their distance from Memphis ranges from 200 to 250 miles. The buildings within the fire limits are chiefly of brick, with some iron. The site of this city furnishes good foundations for buildings of every description. About 15 miles of streets and alleys are paved with stone; the material chiefly used for this purpose is limestone from Illinois, Kentucky, Alabama, and Tennessee, and granite and sandstone from the vicinity of Little Rock, Arkansas. Sidewalks are but little paved with stone, and the material chiefly used is limestone and sandstone from Alabama, with curbs of the same material.

MINNEAPOLIS, MINNESOTA.

The following list includes the Minneapolis buildings in which stone enters as an important constituent:

Brick buildings with limestone trimmings from the Trenton formation.....	179
With Berea, Ohio, sandstone trimmings.....	60
With Frontenac dolomite trimmings.....	13
With Joliet or Lemont, Illinois, limestone trimmings.....	3
With Fond du Lac limestone trimmings.....	48
With Kasota stone trimmings.....	11
With Minnesota granite.....	6
Buildings of stone or brick partly trimmed with granite.....	21
Buildings of brick with Vermont marble trimmings.....	1

There are perhaps 20 other brick buildings which have artificial-stone trimmings and 20 which are trimmed with brick of another color, or are painted so as to simulate trimmings of stone, of which no account has been made. This enumeration includes all stone structures; many of them are very large, such as the Washburn A, B, and C flouring-mills, the Pillsbury A flouring-mill, the university of Minnesota, and McAllister college. The list also embraces the Universalist church, the Irish and French Catholic churches, and the Plymouth Congregational church. The Trenton limestone supplied by the quarries of Minneapolis, formerly much used, is being abandoned as material for first-class structures, and in its place are put stones from towns in Minnesota, as well as stone from other states. The argillaceous character of the Trenton strata, and the thin but often lenticular banding of the sedimentary structure, cause the slabs and blocks of this limestone to disintegrate in sheets parallel with the bedding, and finally to wholly decay; when it can be kept from exposure to the weather it answers for walls better; hence it is still employed in foundations and in basements that rise a few feet above the ground. It is necessary even in such cases that it be well bedded in mortar and protected by a good water-table.

The use of stone as a material of construction at Minneapolis has been greatly influenced by an abundant supply of two other articles, as follows, viz.: Cream-colored brick and pine lumber. It is becoming very fashionable to use red pressed brick from Saint Louis or Philadelphia or Baltimore for the fronts of first-class structures, trimming them with sandstone from Ohio, or limestone from Stone City, Iowa, or Joliet, Illinois. The piers of the suspension bridge over the Mississippi river and its anchorages are of the Trenton limestone, from Minneapolis, trimmed with Minnesota granite. The piers of the two other highway bridges and of the railroad bridge across the Mississippi are of the same material. The arched bridge across the east channel of the Mississippi is of the same, but has Red Wing rock in the angles. In several residences and business blocks artificial stone is used for window-caps or other trimmings, but with Trenton limestone sills, basements, and water-tables. Lemont, Illinois, limestone is seen in a few buildings which have other stones for trimmings. Steps and water-tables of Kasota stone are frequently put in buildings that have other stones for trimmings. In the Westminster Presbyterian church brown sandstone from Fond du Lac, Saint Louis county, Minnesota, is used.

The streets are but little paved, and the material used is a water-worn cobble-stone from the drift. Sidewalks are but very little paved with stone, owing to the abundance of pine lumber and its cheapness. In such sidewalks as are paved with stone, Niagara limestone, from Joliet, Illinois, Trenton limestone, from Minneapolis, and calciferous sand-rock, from Kasota, Minnesota, are used. The curbstones are of Minneapolis Trenton limestone.

MOBILE, ALABAMA.

The only stone building in Mobile—the custom-house—is built of Quincy, Massachusetts, granite. The streets in the business portion of the city are partially paved and macadamized with stone ballast from vessels and the Alabama sandstone. The sidewalks are paved with Alabama sandstone and brick; sandstone from Colbert county, Alabama, is used to a limited extent for this purpose; also the North River blue-stone and stone brought from Yorkshire, England.

NASHVILLE, TENNESSEE.

The stone chiefly used for fronts in the city of Nashville is oolitic limestone from Bowling Green, Kentucky. It is a good material, but contains petroleum which is drawn to the surface by the heat of the sun, and dust settling on it turns it a dark color. It is not uniform in color, but has yellow streaks. The United States custom-house is built of this material. The limestones of the Nashville formation are found in three principal layers; the quality and appearance vary in the same layer. The quarry from which the stone for the capitol is built was abandoned for the reason that the material is very fossiliferous and the fossils (*orthoceras*) weather out. Some of the courses are liable to decomposition when exposed to the weather. The stone is very distinctly laminated; it is not a pure limestone, but has considerable silica in its composition. It is most durable when laid in walls, as in the natural bed. The use of stone for construction is very general in Nashville, nearly every building of any prominence having considerable stone in its composition, and all new stores have fronts either entirely or partially of stone.

Stone basement stories, with the upper portions of brick with stone trimmings, is a very common form of construction. The usual custom is to use the Nashville limestone below ground, and above ground a Nashville limestone, carefully selected, with Bowling Green superstructure and trimmings. There is a desire at present to substitute some other stone for the Bowling Green for the purposes of construction in which that material is now used. The capitol building is constructed entirely of stone; the pillars of the halls of the legislature and ornamental work, railings, etc., are of Hawkins and Knox County marbles. The stone used in the walls of the building is from the next to the lowest course of the Nashville formation.

The Normal College buildings are of local stone. The basements of the Vanderbilt and the Fisk universities are of Nashville stone; the copings and trimmings are of Bowling Green limestone, and their foundations are of selected Nashville limestone. The new United States custom-house is constructed entirely of Bowling Green limestone.

The ruling taste here at present seems to favor white building stone; two churches built many years ago are of Nashville limestone, and stuccoed to represent brownstone; another church is built of rough Nashville limestone of a bluish color. No granite is used in this city for building purposes. The stone used in cemeteries is chiefly Italian marble; however, the Knoxville marble is rapidly coming into use as a material for cemetery work, as it seems but little affected by exposure. There are some monuments of Quincy granite. There is a growing sentiment in favor of paving streets with stone, as the limestone now used in macadamizing powders rapidly, making an offensive dust in summer and mud in winter. Limestone of the Nashville, Cincinnati, or Hudson River formation is used for every character of work except fronts; it is frequently quarried in getting out foundations in such large quantities that it is given away. The walls of yards around the city are constructed of it; some with rough and some with dressed surfaces. Walls of buildings on the river and piers of the bridges are built of it; occasionally in handsome fences around large inclosures of fine residences, the corner and gate posts are constructed of Bowling Green limestone, and the wall around the capitol grounds is constructed of this material.

NEW ALBANY, INDIANA.

The percentage of stone construction in New Albany is small, the material chiefly used being brick and wood, with brick foundations under the frame buildings; but so far as stone has been used here it has shown itself to be substantial and durable, the materials being of superior quality. There are no local circumstances unfavorable to stone construction, and the stones used are limestone from Salem, Indiana, and, to a limited extent, sandstone from the vicinity. The West Salem limestone was employed in the construction of the court-house. For foundations and underpinnings and for other ordinary purposes limestone from the vicinity is employed. The streets are largely paved with cobble-stone and limestone found in the neighborhood. But few of the sidewalks are paved; the stone used is limestone from New Albany and Vernon; curbs are of the same material.

NEWARK, NEW JERSEY.

Nearly all of the prominent stone structures in Newark are built of the Newarksandstone, but the elegant United States custom-house and post-office building and the large and massive county court-house are of Little Falls, New Jersey, sandstone. Nearly all of these buildings are large and costly structures, and the beauty and durability of the stone used are exhibited to good advantage in many of them. Some of the larger edifices are especially deserving of

notice. The extensive use of stone in Newark is to be explained from the fact that there are five quarries of sandstone within the city limits; three of them are now worked, employing from 100 to 200 men, and their product is valued at \$150,000 to \$200,000 annually. There are many large and expensive private dwellings entirely of stone, and many with only stone fronts. Three bridges over Second river and 24 over the Morris canal are of Newark sandstone, and 2½ miles of the Morris canal is walled with the same material. Six railroad bridges beside wagon bridges over the Passaic river have piers and abutments of Newark sandstone. One large trunk sewer is built of the same material, as are also many walls about lawns and cemeteries. The total length of improved and graded streets is 176.8 miles; of streets paved with cobble-stones, 28.76 miles; paved with granite and trap blocks, 4.89 miles; Telford or macadamized streets, 12.21 miles; total of stone pavement, 45.86 miles. The total length of streets graded and improved but not paved is 130.94 miles. The narrow streets have sidewalks 4 feet in width; other streets or sidewalks 5 and 6 feet in width. The material used in paving these sidewalks is the North River blue-stone. No brick is allowed to be used for this purpose.

NEW BEDFORD, MASSACHUSETTS.

Of the 22 buildings in New Bedford constructed entirely of stone, 19 are of granite quarried in the vicinity, 2 of Rockport granite, and 1 of Quincy granite. At the entrance to New Bedford harbor is a large fort, while a smaller one guards the Fairhaven side opposite. They are both constructed of Cape Ann granite. Foundations and underpinnings are of granite from the vicinity of the city and from Rockport. The streets are largely paved with cobble-stone from the vicinity; North River flagging stone is exclusively used in the sidewalks; curbs are of granite from Rockport, in the vicinity.

NEW BRUNSWICK, NEW JERSEY.

The comparative cheapness of brick has interfered with the use of stone both for building purposes and for sidewalks. The red sandstone quarried in the city was formerly used to a limited extent in cellar walls and foundations, but the quarries are now discontinued. This stone has not proved to be durable, crumbling slowly when exposed to severe frost. It is adapted to use in inside filling of walls only, and the greater durability and cheapness of brick have enabled the builders to dispense with it entirely. North River blue-stone has a large use in building for steps, sills, caps, and other trimmings, especially in factories and storehouses. The college buildings afford examples of good and poor stones and of materials improperly laid; the old college building rear wall contains some soft argillaceous sandstone, which tends to split, although laid as in its bed in the quarry. In the west wall there are many stones which show clay-holes. The Geological Hall building has a few examples of stone from Connecticut quarries, which are laid with the lines of bedding in a vertical position, and they are beginning to chip or scale off, although the building has been constructed only ten years. The superiority of the Newark stone is apparent in comparing the general effect, and in the closer examination of the single blocks as they occur in these two structures—the Geological hall and the Kirkpatrick chapel. The Newark stone does not show the lines of bedding so plainly; it is more homogeneous in its composition, and its materials are not so much arranged on lines or in parallel planes as they are in the Connecticut stone which is ordinarily put on the market here. The durability of the Newark stone is displayed in the old college building, erected in 1809; the corners and edges are still sharp and well defined. The following are some of the principal structures of stone, with the materials from which they are constructed: Rutgers college (main building): Newark sandstone; Geological hall: Connecticut sandstone; Kirkpatrick chapel: New Jersey sandstone; First Reformed (Dutch) church: gneiss from New York; the Protestant Episcopal church and Saint Peter's Roman Catholic church: New Jersey sandstone; residence of John Carpenter, residence of Sisters of Charity, and Bartel's private residence: Connecticut sandstone; piers of the wagon bridge over the Raritan river at Albany street: Connecticut brownstone; Pennsylvania Railroad company's bridge (8 piers and abutments): from Stanton, Hunterdon county, New Jersey, and gneiss from Conshohocken, Pennsylvania; the locks of the Delaware and Raritan canal: Trenton freestone, Greensburg quarries. These locks are 200 feet long, or 250 feet including the wing walls; one is a double lock.

The following is a statement of the amount and kind of stone street pavement in New Brunswick:

	Miles.
Granite block, Westerly, Rhode Island, granite.....	1½
Cobble-stone.....	2½
Telford macadamized road of trap-rock.....	1½
Total stone street pavement.....	4½
Nicholson wood pavement.....	1
The sidewalk of North River blue-stone laid by a street commission.....	8
Curbstones, mainly of North River blue-stone.	

NEWBURGH, NEW YORK.

The nearest available source of building stone for Newburgh is the limestone quarries within 2 miles of the city. The material obtained there is used for foundations, underpinnings, and other work of that class; Connecticut brownstone and Haverstraw stone are also used for foundations. Of the stone buildings in the city the oldest is a story-and-a-half dwelling-house constructed of surface stones from the vicinity, and occupied by Washington as headquarters during the encampment at Newburgh. Saint George's Protestant Episcopal church is an old building of blue limestone obtained west of the city. Saint Patrick's Roman Catholic church is a new and large structure of blue limestone, a stone which is much disfigured by what seem to be argillaceous seams traversing irregularly the calcareous matrix. The darker shades of color in these clay seams give the whole a rather dingy appearance. The stone was obtained in part from the quarries west of the city and in part from Kingston, Ulster county; the latter stone has suffered more by exposure. It resembles in this respect the stone in the Second Reformed church in Kingston, and both show how much care is needed in the selection of limestone for fine work in prominent buildings. The First Presbyterian church, a very large, costly, and ornate edifice, constructed of graywacke and flagging stone quarried near Kingston, is trimmed with Ohio sandstone; the stone has retained its dark color, and does not show any signs of disintegration by weathering. The other buildings are small and private excepting the stuccoed Reformed Church edifice. Formerly brownstone from Haverstraw and Nyack was much used for door-steps and window-sills, but of late Connecticut brownstone and Ohio sandstone have been used almost exclusively, excepting the blue limestone from the neighboring quarries, which is used for rough work and cellar walls. Brick here takes the place of stone to a very great extent in both foundations and superstructures. The sidewalks are all laid with blue flagging stone; in the older streets they are from 10 to 12 feet wide, and the stones are of irregular size and generally small. The more recently laid walks are 6 feet wide and are a single line of stone. The cost of paving some of the fine foot-sidewalks has been \$1 per linear foot. The length of sidewalks is unknown, but amounts to many miles. The cobble-stone pavements measure 10,000 feet; the average width may be 40 feet. In the front of a single block in Water street the pavement is Belgian block. The sidewalks are all paved with blue-stone from Ulster county, with curbstones of the same.

NEWBURYPORT, MASSACHUSETTS.

There are but two buildings in Newburyport constructed entirely of stone, and the material used is Cape Ann granite. Foundations and underpinnings are usually of the same material, but Maine granite is used for the same purpose to a limited extent. With the exception of a very few public buildings, stone is used only in the underpinnings and foundations. It is observed that the Cape Ann granite, the stone chiefly used here, is of a light color when quarried and grows dark with exposure, but does not decay. The Peabody granite becomes of a yellowish-brown color after long exposure to the weather. A ledge has been recently opened about 2 miles above Newburyport, on the Merrimack, for the purpose of extracting stone for the construction of a jetty across the sand-bar at the mouth of the river. The material quarried is called by the workmen common stone or trap. Sandstone from Springfield has been used to a very limited extent for trimmings. The little stone street pavement in this city is of Maine granite; the sidewalks are not paved at all, and the curbs are of Maine and Cape Ann granites.

NEW HAVEN, CONNECTICUT.

In New Haven, as in most of the other cities of Connecticut, the brown sandstone from the Connecticut valley furnishes the chief part of the material for stone construction. The other materials used are granite from Long Island shore, gneiss from Ansonia, trap from the East and West rocks, and sandstone from East Haven and Ohio. The breakwater in New Haven harbor has been built partly of coarse granite from the Branford quarries; considerable of East Haven sandstone has been used in bridge approaches, abutments, and piers; some 2 or 2½ miles in length of the side walls of the old canal, in which the railroads cross the city, are built entirely of East Haven sandstone and trap, about equal quantities of each being used, and requiring between 8,000 and 10,000 cubic yards of stone. Some of the Ohio sandstone used in New Haven, notably in one building, contains iron pyrites, which oxidizes on exposure to the weather, giving the stone a soiled appearance. The only defect noticeable in the Portland sandstone is that it scales off if laid otherwise than as in the quarry bed. The basement story of the old state-house is of limestone, which has crumbled very badly, and the material has not been used in any other structures. Brown sandstone from Newark, Essex county, New Jersey, was employed to some extent in some of the Yale College buildings. For foundations and underpinnings trap and East Haven sandstone are the materials used. Most of the streets are telfordized with trap from the East and West rocks. The sidewalks are but little paved with stone; the material used is North River blue-stone, with, in a few instances, mica-schist from Bolton, Connecticut. The curbstones are chiefly North River blue-stone, but granite has been used to a limited extent for the same purpose.

NEW LONDON, CONNECTICUT.

New London is built on granite rocks. Stone for cellars, foundations, and underpinnings is quarried almost anywhere within the city limits. The whole of the walls of the large Catholic church, and of another large granite church building, are built of stone quarried on the sites of buildings, the stone for trimmings coming from one of the quarries at Groton. The surface stone in New London, and also in neighboring quarries, is striped in appearance, not uniform, some pieces being more variegated than others. The color varies also considerably, but is always the same shade of gray.

Only 1 per cent. of the buildings is of stone, which is due simply to the question of first cost. Forts Trumbull and Griswold are built of granite from Groton or Millstone point.

The streets are but little paved with stone, and the material used for this purpose is the rectangular blocks of Groton granite. The sidewalks of the principal streets are paved with North River blue-stone and some Groton granite. The curbstones are Groton granite.

NEW ORLEANS, LOUISIANA.

The percentage of stone construction in New Orleans is very small. A large proportion of the houses are built of wood. The streets were all paved before the late war. There is one building, situated in the southern part of the city, entirely of rough-hewn stone from Sainte Genevieve. The custom-house is nearly all built of Quincy granite. Another building, on the corner of Royal and Canal streets, is built mostly of granite. A monument to General Robert E. Lee is now in course of construction; the base is of Georgia granite; the foundation on piles, and transverse timbers in concrete; the shaft is of Knoxville, Tennessee, gray marble; and this latter material is very highly esteemed here. The few stone fronts are of Westchester, New York, snowflake marble and Sainte Genevieve limestone; a good deal of the latter material was formerly used. The chief material now used for fronts is iron; the amount of stone used for purposes of construction in New Orleans since the war is very inconsiderable. The Westchester limestone was considerably employed before the war, and also the Sainte Genevieve limestone, for tombs and fronts; at present a great deal of brick is used and stuccoed. The use of artificial stone in buildings and pavements is increasing. The stone used for ornamental purposes is usually Italian marble, with some Vermont marble. Some Quincy granite was formerly brought to the city and used for curbstones, flagging, and purposes of that nature; as it was usually brought as ballast in ships, the expense attending its use was inconsiderable. The water is so near the surface in New Orleans that it is impossible to have stone foundations; the customary way is to lay thick planks transversely and to place the brick immediately on them; they are sometimes creosoted, but usually last well below water. This system of foundations is considered better and less expensive than driving piles. The sewers consist of stone-faced gutters, through which the water passes every night from the river to the lake; 221,760 feet, or 42 miles, of blue-flint banquettes; 42,240 feet, or 8 miles, slate-stone banquettes; 15,840 feet, or 3 miles, Schillinger artificial stone; in all, 279,840 feet, or 53 miles, of stone banquettes.

The following is a statement of the number of miles of stone street pavement: 113,520 feet, or 21½ miles, of Quincy granite square-block pavement; 15,840 feet, or 3 miles, of other square-block pavement; in all, 129,360 feet, or 24½ miles.

The greater part of the street pavement is of cobble-stone, brought as ballast; 42 miles of sidewalk pavement are of North River blue-stone; 7 miles of slate.

NEWPORT, RHODE ISLAND.

The materials most used in the better class of stone construction in Newport are Connecticut brownstone and Newport granite. Fort Adams is built of Westerly and Fall River granite, together with some of the local slate. The macadamized Telford road is much used in Newport and the stone employed is the local granite. The foundations and underpinnings are built of Newport granite; the streets are but little paved with stone, and the material used is cobble-stones from Block island and from Nova Scotia. Asphalt manufactured at Providence is much used for street paving. The sidewalks in the business portions of the city are paved with Hudson River flags and asphalt. The curbstones are Hudson River blue-stone and Fall River granite.

NEWTON, MASSACHUSETTS.

The city of Newton includes Newton, Newton Center, Newton Upper Falls, Newton Lower Falls, Newton Valley, West Newton, and Auburndale. Of the stone buildings enumerated three are churches, three private residences, and one mill; one church built of Ohio sandstone was rebuilt from the old Chauncey Street church, Boston. The material for foundations and underpinnings is granite obtained from the boulders found in the vicinity, with some Westford granite. The streets are not paved with stone; a very few of the sidewalks are paved with Westford granite, with curbs of the same material.

NEW YORK CITY AND ENVIRONS.

By Dr. ALEXIS A. JULIEN.

City.	County.	State.	Population.
New York city.....	New York.....	New York.....	1, 206, 500
Brooklyn, including Williamsburg and Long Island City.....	Kings.....	do.....	583, 806
Castleton, etc. (Staten Island).....	Richmond.....	do.....	40, 000
Jersey City, including Hudson City, Bergen City, Bayonne, and Greenville.....	Hudson.....	New Jersey.....	120, 728
Hoboken, including West Hoboken, town of Union, and Weehawken.....	Hudson.....	do.....	30, 999

This district embraces the principal suburbs of the great metropolis, although the crowded trains and boats which constantly leave all the railroad stations and docks, especially in the morning and evening, point to the outer ring of suburban cities and villages, in the Hudson River counties, on Long island and in New Jersey, whose construction and enlargement chiefly depend for supply of material upon the stone- and brick-yards of New York island.

The statistics embodied have been obtained from many sources, partly by direct counting of houses from street to street, etc., partly by the issue of circulars, and partly by personal application to stone dealers, stone-yards, etc.

The courteous consideration with which, in general, my inquiries have been received calls for my special acknowledgment and thanks to a large number of persons, of whom I ought perhaps specially to name the following: James Wells, insurance agent, 167 Broadway; William E. Midgley, assistant secretary New York and Boston Insurance Company, Howard building, 176 Broadway; J. H. Langford & Co., insurance agents, 10 Pine street; the New York Board of Fire Underwriters; F. Collingwood, engineer in charge of New York approach, New York and Brooklyn bridge; David Acker, deputy commissioner of department of buildings, Brooklyn; James A. Baker, clerk of village of Edgewater, Staten island; J. R. Wardlaw, clerk, etc., Edgewater, Staten island; Miller & Simonson, West New Brighton, Staten island; John H. Cordes, real estate agent, 163 Harrison avenue, Brooklyn; Gill & Baird, John Vesey, Andrew Mills, New England Granite Works, Gillie & Walker, the Bay of Fundy Quarry Company, D. Hotaling, Brander, Boyd & Hutcheon, and Browne, McAllister & Co.

In compliance with my request for specimens of stone, trimmed in accordance with the directions of the building-stone department of the census, many such specimens have been sent to the National Museum at Washington, sometimes with a duplicate intended for the American Museum of Natural History in this city. For these we are specially indebted to the following firms, so far as I have been notified: New England Granite Works, James Morgan & Co., the Bay of Fundy Quarrying Company, and Browne, McAllister & Co.

My report is naturally divided into three parts:

I. The buildings of New York and adjacent cities, etc., their numbers, and common materials.

II. The building stones of these cities, described in some detail, their localities, and examples of edifices constructed of each variety. Public buildings and improvements, with description of materials employed; materials of pavements and roofs; market prices of building stones.

III. Durability of building stones in this district; agents of destruction; elements of strength and durability; methods of trial; means of protection and preservation. (This will form the subject of another chapter, and will be found on pages 364 to 393.

With a field so broad, and with imperfect sources of information, my report can hardly be free from errors and deficiencies; but every effort has been made to avoid them so far as time and opportunity have permitted.

I.—THE BUILDINGS OF NEW YORK AND ADJACENT CITIES; THEIR NUMBERS AND COMMON MATERIALS.

It may be as well to state here that the published maps used by the insurance companies, in which the position and approximately the material of each building are supposed to be laid down, are far from accurate. Not only have the additions and removals of buildings been in some cases imperfectly represented, but on many maps little attempt seems to have been made to exhibit the nature of the material (*i. e.*, of the faces) of the buildings, whether brick or stone. It has been necessary to correct these points, for the purpose of the census, by personal examination of many districts.

The building statistics have been arranged (Table I) to indicate the exact materials of construction in each city, and in an approximate way, the number of buildings erected for special purposes and the selection of materials employed for them. These figures are almost entirely derived from personal inspection and actual counting of the buildings in the several districts. The city of New York comprises an area of 24,893 acres, which may be divided into three great districts, viz:

1. District of wholesale business houses, comprising the entire area of the island south of the line of Canal and Rutgers streets, from the North (Hudson) river to the East river; also the buildings along the line of Broadway up to Fourteenth street.

2. District of small stores and tenements, comprising the area north of the line of Canal and Rutgers streets, and east of the Bowery and Third avenue, up to the Harlem river; also, the entire Twenty-third and Twenty-fourth wards, up to the northern boundary of the city at the Yonkers line.

3. District of large stores and residences, comprising the area north of the line of Canal street, and west of the Bowery and Third avenue, up to the Harlem river at Spuyten Duyvil.

In the city of Brooklyn the lines are much less sharply and easily drawn; however, three districts may be distinguished:

1. District of warehouses, tenements, etc., comprising wards Nos. 2, 4, 5, and 12, and portions of Nos. 1 and 6; *i. e.*, the area bounded by the following line: East river, Hudson avenue to Willoughby avenue; Willoughby avenue to Fulton street; Fulton street to Furman street; Furman street to Atlantic avenue; Atlantic avenue to Hicks street; Hicks street to Cole street; Cole street to Clinton street; Clinton street to Rush street; Rush street to Gowanus bay; along shore of Gowanus bay; Buttermilk channel to Fulton street, East river.

2. District of residences and small stores, comprising the rest of the city, including Williamsburg.

3. District of small residences, comprising the suburb called Long Island City (population 17,117).

The statistics of Jersey City, Hudson county, New Jersey, were gathered in two divisions:

1. Jersey City, including Hudson City and Bergen City, La Fayette, and Communipaw.

2. Bayonne and Greenville.

The statistics of Hoboken, Hudson county, New Jersey, have been gathered under three heads:

1. Hoboken proper.

2. West Hoboken and town of Union.

3. Weehawken.

It has been thought desirable to make this subdivision of the statistics, in reference to these small and, in many cases, at present unimportant places, in view of the enormous growth by which they are liable to be affected in the vicinity of the great metropolis.

Finally, as a matter of general interest, and for the purpose of proper comparison with the other great cities of the world, all the statistics above mentioned have been summed up under the head of New York city and its suburbs.

It may be here noted that a general improvement in the character of the building materials employed is constantly in progress in all these cities, so that the number and proportion of stone buildings have in many cities been sensibly increased since the year 1880; to which date all the statistics in this report, so far as possible, have been made to conform.

A consideration of this table presents the following chief points of interest:

NEW YORK.

Stone enters into the construction, chiefly as fronts, of 11.6 per cent. of all the buildings of the city. Of the entire number of stone buildings, 89.4 per cent. consist of sandstone, and the several varieties of stone occur in the following proportion:

	Per cent.
Brown sandstone.....	78.6
Nova Scotia and Ohio sandstones.....	10.6
Marble.....	7.9
Granite.....	1.8
Gneiss.....	0.9
Foreign sandstone.....	0.1
Blue-stone and limestone.....	0.1

The materials of general construction in the city occur in the following proportion to the total number of buildings:

	Per cent.
Brick, terra-cotta, stucco, etc.....	63.2
Frame, <i>i. e.</i> , wooden in part, filled in with brick.....	24.3
Stone.....	11.6
Iron.....	0.9

In the business district brick predominates (77 per cent.), and most of the marble, and somewhat less than half of the iron buildings occur. The remaining iron buildings are mostly found on the large business streets in the other districts.

The tenement district still consists of frame buildings to the extent of 31.7 per cent., nearly half of the entire number in the city. Stone constitutes only 5.5 per cent. of the fronts, though largely employed in the trimmings; and iron and marble are rare. Brick somewhat predominates (62.6 per cent.).

In the residence district brick also predominates (60.9 per cent.), but stone is largely used (14.6 per cent.), including 70 per cent. of all the stone buildings of the city. However, the district comprises, in its unsettled and

partially-built areas, the greater part (55 per cent.) of the wooden buildings of the city. Here most of the stucco buildings occur, but their number (166) is very small, particularly in comparison with their abundance in the metropolis of England.

BROOKLYN.

Stone is here employed in a proportion (9 per cent.) a little less than that of New York (11.6 per cent.), and in much less variety, the Connecticut brownstone predominating (95.7 per cent.) in the entire number of stone buildings. This stone is employed altogether for the residences throughout the city. Very few iron buildings occur, but there are over three times as many stucco fronts as there are in New York. The frame buildings constitute half of the entire number (50.9 per cent.), especially predominating in the outskirts, as in Long Island City (80.5 per cent.).

STATEN ISLAND.

Stone enters in a very small proportion into the construction of fronts of buildings on this island (5 per cent.), though it is commonly employed for trimmings, walls of inclosures, and other masonry. Brick is largely employed, especially in the towns and villages (9.5 per cent.), but the common material is wood (90 per cent.).

JERSEY CITY.

In the suburbs of this city the proportions of stone and brick employed are very similar to those on Staten island. But in Jersey City proper the predominance of frame-houses is much less, the buildings amounting to 1.9 per cent., and the brick to 25.9 per cent. The selection of the dark trap-stone from the heights behind the main city for the construction of many fronts or of entire buildings is a peculiar local feature.

HOBOKEN.

The materials of construction in the suburbs of this city, upon the top of the trap ridge, etc., are similar in proportion to those on Staten island and in the suburbs of Jersey City. In Hoboken proper the proportion of stone buildings is large (3.9 per cent.), and the brick buildings constitute over half (52.7 per cent.) of the entire number.

THE METROPOLIS.

Finally, in regard to the whole district, it will be seen from the table that stone enters into the construction of the fronts of 9.1 per cent. of all the buildings of this city, though it is employed otherwise to an enormous extent for foundations, trimmings, walls, copings, stoops, etc. I have not been able to obtain sufficient data for the estimation of the entire import of stone into the city; but some idea of the vast expenditure involved in the construction of our buildings may be derived from the reports of the superintendents of the building departments of New York and Brooklyn, and have suggested the following by a writer in the *Am. Arch. and Building News*, 1878, Vol. III, page 71:

It would seem from it that the average cost of a new building in New York city has been \$13,741, and that with some additions of work, not formerly reported to the superintendent, the aggregate sum spent in adding to the plant and material on Manhattan island has reached the enormous sum of about \$350,000,000.

From the annual reports of the committee on the fire patrol to the New York board of fire underwriters, of 1881 and 1882, the statistics given below have been extracted:

Number of buildings in New York city south of Fifty-ninth street:		
South of Canal street, west of Broadway	3,555	
South of Canal and Rutgers streets, east of Broadway.....	6,998	
		10,553
Lower district, south of Canal street:		
Between Canal and Fourteenth streets, west of Broadway	10,219	
Between Canal and Fourteenth streets, east of Broadway.....	16,481	
		26,700
Lower central district, between Canal and Fourteenth streets:		
Between Fourteenth and Fifty-ninth streets, west of Fifth avenue.....	20,559	
Between Fourteenth and Fifty-ninth streets, east of Fifth avenue	13,256	
		33,815
Upper central district, between Fourteenth and Fifty-ninth streets:		
North of Fifty-ninth street, west of Fifth avenue.....	6,372	
North of Fifty-ninth street, east of Fifth avenue	12,374	
Upper district, between Fifty-ninth street and Harlem river.....		18,746
New York city, Battery to Harlem river.....		89,814

The area comprised by the enumeration does not include that of the Twenty-third and Twenty-fourth wards north of the Harlem river, and the total, therefore, falls below that of the last column of the table given on page 329. The materials of construction are reported as follows:

Brick, with stone trimmings and in part with stone facings	64,783
Brick and frame	3,616
Frame	21,415
Total	89,814

Of this number the stores amount to over 5,300, whose value, at an average of but \$100,000 each, might be estimated at \$53,000,000.

Another enumeration of the number of buildings in New York city is now being carried on by committees of the fire department, but will not probably be completed for many months.

II.—THE BUILDING STONES.

A. VARIETIES, LOCALITIES, AND EDIFICES.

The series of buildings employed in New York and adjacent cities is rich and varied, comprising materials derived by water carriage from most of the sea-ports of New Brunswick and New England, and from many points along the Hudson river, and by railway from the interior of all the New England and middle states, even as far west as Indiana.

The only careful description of our American building stones yet made is found in the report of Dr. J. S. Newberry on the building stones displayed at the exposition at Philadelphia in 1876, and it will suffice for the object of this report to quote freely from the descriptions of varieties there given. It may be also remarked that from time to time various building stones have been brought to this market from numerous quarries of limited extent which have soon become exhausted; *e. g.*, the granite from Dix island. So large is the number of building stones, and so scattered are the sources of information concerning them, that some of subordinate importance may very likely not be included in the following list. In most cases prominent examples are given of the use of stone in the larger or public buildings of the city, both as ashlar for fronts and as the trimmings of buildings mainly constructed of brick.

The materials most commonly in favor for facings of the fronts of our buildings consist of red pressed brick, which is glaring and offensive to the eye; white marbles, which are at first too bright, but soon assume a dirty cream-colored tinge of discoloration; drab or olive-gray freestones, which rapidly become discolored by blackish-gray stains on fronts exposed to the north and east, and brown freestones or brownstones, very generally used for the ashlar fronts of residences. This latter stone presents rather a somber and cheerless aspect under a cloudy sky on a winter day, and imparts a great monotony to the appearance of our cross-streets; nevertheless, under the bright sky and brilliant atmosphere of many days of spring and winter, and above all of the summer in New York, it is not trying to the eye nor glaring like brick or marble or the light-colored granites and freestones.

The following details have been gathered partly from my own observation and that of my assistants, but for many particulars, especially in regard to examples of construction, I have been indebted to various persons, and I have not been able to verify them all:

FREESTONE (sandstone).—Shepody mountain, Hopewell, Albert, New Brunswick. Pale olive-green, and of medium fineness; uniform texture and tint, and of good strength; is a durable and serviceable stone, generally admired for its color (J. S. Newberry). Derived from the Millstone Grit formation. Examples of construction. (See Freestone of Dorchester, New Brunswick.)

FREESTONE (sandstone).—Mary's Point, Albert, New Brunswick. Colors, salmon, olive, and dark brown. Derived from the Lower Carboniferous formation. Examples of construction: The Reformed church, corner of Fifty-seventh street and Madison avenue; the fence surrounding Central park, the bridges, fountain, basin, and most of the freestone masonry in the park; also the similar masonry in Prospect park, in Brooklyn.

FREESTONE (sandstone).—Wood Point, Westmoreland county, New Brunswick. Color, dark brown. Examples of construction. (See below.)

FREESTONE (sandstone).—Sackville, New Brunswick. Derived from the Lower Carboniferous formation. Examples of construction. (See below.)

FREESTONE (sandstone).—Harvey, New Brunswick. Derived from the Lower Carboniferous formation. Examples of construction. (See below.)

FREESTONE (sandstone).—Dorchester, New Brunswick. Derived from the Lower Carboniferous formation. Examples of construction: Stoops and part of trimmings of Normal college, Sixty-eighth street and Lexington avenue; building of New York Historical Society, corner of Second avenue and Eleventh street; part of the wall and bridges in Central park. Trimmings of the Academy of Music, Montague street, Brooklyn.

FREESTONE (sandstone).—Weston, New Brunswick. Derived from the Lower Carboniferous formation. Examples of construction: Part of the wall and bridges in Central park.

FREESTONE (sandstone).—Kennetcook, Hants county, Nova Scotia. Colors, olive and blue. Derived from the Lower Carboniferous formation. It is also used for grindstones. Examples of construction. (See below.)

General examples of the construction in the "Nova Scotia" stone: Church in Twenty-fifth street, east of Fifth avenue; hotel Bristol, Forty-second street, near Fifth avenue; churches: Madison avenue, near Fifty-seventh street; Fourteenth street, west of First avenue; Fourteenth street, west of Sixth avenue; Fifteenth street, east of Third avenue; Sixth avenue, near Fifteenth street; Twenty-first street, east of Second avenue; Thirty-fourth street, east of Seventh avenue; Forty-second street, west of Seventh avenue; Lexington avenue, near Forty-sixth street; Lexington avenue, near Sixty-third street; Seventy-sixth street, east of Third avenue; Eighty-ninth street, east of Madison avenue; bank, Broadway, Brooklyn.

FREESTONE (sandstone).—East Longmeadow and Springfield, Massachusetts. Derived from the Triassic formation.

FREESTONE (brown sandstone or brownstone).—Portland, Connecticut. "Some varieties are laminated in structure and liable to exfoliate when used as ashlar and set on edge." This stone imparts a somber monotony of tone to the architecture of our cities. Color light to dark reddish-brown, inclining to chocolate; texture varying widely in fineness, but usually coarser than the similar freestone from Belleville, New Jersey. Examples of construction are abundant in the residences throughout our cities, *e. g.*, on the northwest corner of Fifty-seventh street and Fifth avenue: Academy of Design, in Brooklyn, Montague street, west of Fulton.

FREESTONE (sandstone).—Middletown, Connecticut. Derived from the Triassic formation. Examples of construction: Trinity church, corner of Clinton and Montague streets, and the Methodist Episcopal church, on northwest corner of Clinton and Pacific streets, in Brooklyn.

RED SANDSTONE.—Potsdam, New York. The oldest of all the sandstones, belonging to the Potsdam period of the Lower Silurian formation. Color, a warm reddish brown, slightly mottled and striped with white; structure, decidedly laminated, in thin parallel sheets, often crossed obliquely by obscure fissure lines of lighter color. It is quite refractory, and has been used for lining of iron furnaces. Examples of construction: Quoins, trimmings, and basement of residence in Fifth avenue, near Thirty-fifth street; dressings, string-courses, etc., of building of Columbia college, Forty-ninth street and Madison avenue.

BROWN SANDSTONE.—Oswego, New York. Example of construction: Part of first story of Masonic temple, Twenty-third street and Sixth avenue.

FREESTONE (brownstone).—Newark, New Jersey. Examples of construction: Churches on corner of Forty-eighth and Fifty-fifth streets and Fifth avenue; the synagogue, on Fifth avenue; church on corner of Madison avenue and Fifty-fifth street; Trinity Church school, on Church street; Trinity chapel, on Houston street; trimmings of buildings at Thirty-second street and Broadway, etc.

FREESTONE (sandstone or "brownstone").—Belleville, New Jersey. Derived from the Triassic formation. Colors, brownish-gray, light brown, light reddish-brown, and light orange-brown. Generally finer grained and more compact than the stone from Connecticut. Examples of construction: House on northeast corner of Fiftieth street and Madison avenue; Church of the Messiah, northwest corner of Thirty-fourth street and Park avenue; trimmings of many residences in Madison avenue, *e. g.*, on northwest corners of Sixty-seventh, Sixty-eighth, and Sixty-ninth streets, etc.; Baptist Church of the Epiphany, southeast corner Madison avenue and Sixty-fourth street; two shades of this stone presented in the church and chapel, Madison Avenue Methodist Episcopal church, northeast corner Madison avenue and Sixtieth street; Presbyterian church, corner Fifty-fifth street and Fifth avenue; Jewish temple, corner of Fifty-fifth street and Lexington avenue, with trimmings of Ohio stone; trimmings of Harney building, 16 Wall street; Seventh Ward bank; Mills building, corner Broad street and Exchange place, and many bridges in Central park; Fort La Fayette; houses on corner of Fifty-seventh and Ninety-third streets and Fifth avenue, and corner of Twenty-eighth street and Madison avenue.

FREESTONE (brown sandstone).—Little Falls, New Jersey. Derived from the Triassic formation. Example of construction: Trinity church, Broadway and Wall street.

FREESTONE (brownstone).—Base of Palisades, New Jersey. Derived from the Triassic formation. Example of construction: Part of the wall in Central park.

FREESTONE (brownstone).—Hummelstown, Pennsylvania. This has been largely used in Philadelphia, and is said to be an excellent variety. Example of construction: Building on Fifth avenue, above Forty-first street.

FREESTONE (sandstone).—Amherst, northern Ohio. Belonging to the Lower Carboniferous or Waverly series. Fine-grained, homogeneous sandstone, light drab in color, made up chiefly of grains of quartz; color, permanent. An excellent building stone. Example of construction: Building corner of Barclay street and Broadway, erected twenty years ago.

FREESTONE (sandstone).—East Cleveland, Ohio. Color, drab and dove-colored. Derived from the Waverly and Coal Measures.

FREESTONE (sandstone).—Independence, Ohio. Color, light drab, and coarser than the stone of Amherst. Derived from the Waverly and Coal Measures.

FREESTONE (sandstone).—Berea, Ohio. Derived from the Waverly and Coal Measures. Not quite so fine grained as the Amherst; a light bluish-gray, generally a strong and durable stone, sometimes liable to discoloration

by decomposition of pyrites. Examples of construction: New York *Clipper* building; block on corner of Cliff and Fulton streets; Church of Transfiguration; west side of Sixth avenue, above Twenty-seventh street; Decker's building, in Union square; churches: One hundred and ninth street, near Madison avenue; One hundred and sixteenth street, near Third avenue; South Fifth street, near Canal; Bond building, on Broadway, next Trinity building; front of Rossmore hotel, Forty-first street and Broadway; trimmings of house, northwest corner of Forty-third street and Madison avenue; William's Savings bank, corner Broadway and Fifth street, Brooklyn, eastern district (with basement and pilasters of Quincy granite); Berea hall, Brooklyn, etc.

BUENA VISTA FREESTONE (sandstone).—Portsmouth, Scioto county, Ohio. This belongs to the lower part of the Waverly series. It is finer grained and less siliceous than that from northern Ohio, "and has generally a more decided bluish tint when freshly quarried, but becomes lighter and more yellowish on exposure." It varies in color from brown, dove-colored, banded and mottled red and yellow to black.

Though some varieties of this stone are liable to stain and exfoliate, from the oxidation of the contained iron, as a general rule it is an excellent and very hard sandstone, taking rank with the best and handsomest of the freestones of the country.—J. S. N.

FREESTONE (sandstone).—Waverly, southern Ohio. Derived from the lower part of the Waverly series.

Within a few years a considerable quantity of stone, which is known in New York by the name of "Carlisle" or "Scotch" stone, has been brought into New York as ballast. It is not the English stone known by the former name in England, but comprises three varieties of Scotch sandstone, here called merely by the name of the English port at which the stone is shipped, Carlisle. Each stone will be separately considered:

1. **CORSEHILL FREESTONE** (sandstone).—Corsehill, near Annan, in Dumfries county, about 60 miles west of Glasgow, Scotland. Derived from the new red sandstone. Color, dark red to bright pink; close grained; weathers well, works easily, fit for ashlar, and well adapted for carving and for columns. Examples of construction: Trimmings of Murray Hill hotel, Park avenue and Forty-first street; stables on south side of Sixty-second street, between Park and Madison avenues; house corner of Fifty-seventh street and Fourth avenue; mantels in residence corner of Fifty-second street and Fifth avenue; trimmings of the Berkshire building, northwest corner of Madison avenue and Fifty-second street.

2. **BALLOCHMILE FREESTONE** (sandstone).—Ballochmile, Forfarshire, Scotland. A little darker in color than the Corsehill stone. Derived from the Carboniferous formation. Examples of construction: Two houses in west Seventy-eighth street; house in Fifty-seventh street and Seventh avenue.

3. **RED FREESTONE** (sandstone).—Gatelow bridge, 30 miles from Ballochmile, Dumfriesshire, Scotland. About equal in quality and perhaps superior in beauty to the Corsehill stone, but much superior to the Ballochmile stone. Example of construction: The only building constructed of this stone is the house on southeast corner of Forty-second street and Fifth avenue.

RED SANDSTONE.—Frankfort-on-the-Main, Germany. Example of construction: Building in Sixty-eighth street, east of Third avenue.

BLUE-STONE (graywacke).—Albany, Delaware, and Greene counties, New York. The Greene County stone is obtained from some heavier beds in the Portage group, along the base of the Catskill mountains, and is shipped at Malden, on the Hudson river.

It is one of the very best flagging stones in the world. It may be quarried in slabs of almost any desired thickness or dimensions, the different layers varying much in this respect. The natural surfaces of these strata are comparatively smooth, and form a good walk without dressing. The stone comes from the Hamilton group of the Devonian system, and forms a belt of outcrop extending from Kingston on the Hudson to Port Jervis on the Erie railroad, and thence southward. It is a fine-grained sandstone, generally dark blue in color—whence its name—and is very strong and durable. When ground or sawed it forms a very smooth surface, and yet one that always has a tooth or grain which holds the foot well, whether wet or dry. In this respect sandstones are much superior to granites and limestones, which become slippery and dangerous when wet.—J. S. N.

Examples of construction: Part of the bridges and wall in Central park.

MONTROSE STONE (blue-stone).—Kingston, Ulster county, New York. A variety more pinkish in color than ordinary blue-stone, but about the same in hardness and general characteristics. Examples of construction: Two stables in Fifty-first street, between Seventh and Eighth avenues; penitentiary on Blackwell's island; flooring of casemates in forts of the harbor; trimmings of National Academy of Design, Twenty-third street and Fourth avenue (with casing); porch of house, 15 East Thirty-sixth street; house in Fifty-seventh street, two doors west of Fourth avenue.

WYOMING BLUE-STONE (graywacke and flag-stones).—Pond Eddy, Long Swamp, the Narrows, Lackawanna, near and in Pike county, Pennsylvania, and across the Delaware river in New York. This stone is mostly shipped to Rondout by the Delaware and Hudson canal. Thickness of the flags and beds, from 2 to 18 inches. It is used for window and floor-sills, step-stones, water-tables, platforms, cellar, prison, and casemate floors, sidewalks, curbs, gutters, the bases of tombstones, candy tables, etc.

The blue-stone is the best; when it is struck with the hammer it has a metallic ring; and the finer the grain of the stone the better, because it is more apt to be smoother, tougher, harder, and truer over the face than a coarse-grained flag.—*The Manufacturer and Builder*, 1876, VIII, 138.

Examples of construction: The basement of residences, Thirty-fourth and Fifty-eighth streets; a building in Seventeenth street, on Stuyvesant square; trimmings of Produce Exchange building.

FREESTONE (limestone)—**CAEN STONE** (oolite) **CAEN**.—Normandy, France. This stone is of a pale cream-yellow color, of a loose, open grain, soils the fingers like chalk, and is very friable. It is very soft when first quarried, but hardens on exposure; is easily worked, sawed and carved, but weathers very badly; weighs from 116 to 142 pounds to the cubic foot. Examples of construction: The former Nassau bank, corner of Nassau and Beekman streets, built in 1828; the reredos in Trinity church; the Tontine building; six residences in West Ninth street, between Fifth and Sixth avenues, erected in 1857; the dormitory in Sixteenth street, adjoining the New York hospital on the Fifth Avenue side; house next to church, Fifth avenue and Twenty-ninth street; the plinths, bands, and cornices of church and parsonage on southeast corner of Nineteenth street and Fourth avenue; bands, mullions, etc., of oriels and general trimmings in Trinity chapel.

LIMESTONE.—Lockport, New York.

This comes from the encrinital layer of the Niagara group, and is a gray limestone thickly set with fossils, most of which are the joints of crinoids. Some of these are tinged with red, while others have a blue or opalescent shade, all of which give an agreeable variety to the color of the stone. It is less hard than the true marbles, and as a consequence takes a less brilliant polish and is more easily scratched. When properly wrought, however, it is quite handsome, and is considerably used for mantels and other purposes.—J. S. N.

Examples of construction: Lenox library, Fifth avenue and Seventieth street, and the dressings of apertures, bands, posts, etc., of the Presbyterian hospital, Madison avenue and Seventieth street.

OOLITIC LIMESTONE.—Ellettsville, Monroe county, Indiana. Example of construction: Office building in Cortland street, next to Coal and Iron Exchange building.

OOLITIC LIMESTONE ("Indiana limestone" or "Bedford stone").—Bedford, Lawrence county, Indiana. Examples of construction: Residences on northwest corners of Fifty-second and Fifty-seventh streets and Fifth avenue; Smith building, Cortland street; lowest story of Appleby Flat building, at Seventh avenue and Fifty-ninth street, and a similar building at Eleventh avenue and Eighty-fourth street; Bridge building, Fourteenth street; rectory, on Fifty-fifth street.

LIMESTONE.—Kingston and Rondout, New York. Examples of construction: Part of anchorages, approaches, and base of towers of New York and Brooklyn bridge.

LIMESTONE.—Isle La Motte, lake Champlain. Examples of construction: Part of the anchorages and towers of New York and Brooklyn bridge.

LIMESTONE.—Willsborough point, lake Champlain, New York. Examples of construction: Part of anchorages, approaches, and base of towers of New York and Brooklyn bridge.

LIMESTONE.—Greenwich and Mott Haven, Connecticut. Examples of construction: Part of wall in Central park.

GRANITE.—Bay of Fundy, Nova Scotia.

It contains almost no mica; is of moderately fine grain, the groundwork composed of a bright, light red orthoclase, mottled with, perhaps one-fourth of the quantity of bluish quartz, and one-tenth or less of black hornblende. It is a very tough and compact rock, and takes as high and uniform a polish as any other variety of granite known.—J. S. N.

Examples of construction: The columns of the Stock Exchange building.

RED GRANITE.—Calais, Maine.

It is composed of pale red orthoclase, with a smaller quantity of a lighter feldspar, possibly albite, with quartz, hornblende, and a little mica. It takes a fine polish, is homogeneous in texture and color, and well deserves the good reputation it enjoys.—J. S. N.

GRANITE.—Bluehill, Maine. Light gray in color, and of good texture. Example of construction: The United States barge-office, Battery.

GRANITE.—Morgan's bay, East Bluehill, Maine.

A compact, homogeneous, light gray granite, composed of relatively large crystals of white orthoclase, with fine grains of glassy quartz and specks of black mica. In color it is one of the lightest of New England granites, and from the preponderance of feldspar, the absence of hornblende, and the granular condition of the quartz, it will work with unusual facility and will prove a handsome and durable stone.—J. S. N.

The stone is handsomely mottled and susceptible of a high polish. Examples of construction: Part of the towers and approaches of the New York and Brooklyn bridge.

GRANITE.—Spruce Head, near Rockland, Maine.

A clear, mottled, white and black syenite, which consists of nearly equal parts of snow-white orthoclase, glassy quartz, and black hornblende. The constituents are firmly united, making it a strong and durable stone, which takes a brilliant polish. The quantity of hornblende in it and the striking contrast in color between this and the feldspar give it a peculiar bright lively tint, which renders it one of the handsomest of the gray granites.—J. S. N.

Examples of construction: Part of towers of New York and Brooklyn bridge; bridges of Fourth Avenue improvement; Jersey City reservoir; hospital building for Sailors' Snug Harbor, Staten island.

RED GRANITE.—Red Beach, Maine.

This is a fine-grained granite, of which the general complexion is reddish, but less positively so than that of most so-called red granites. It is composed of pale red and creamy white feldspar, with smaller masses of smoky quartz, fine grains of black hornblende, and specks of black mica. It takes a good polish and is undoubtedly a strong and durable stone. In quality it will take equal rank with the Jonesboro, and Calais red granites, from which it differs chiefly in its greater fineness of mottling.—J. S. N.

GRANITE.—Hurricane island, Maine. A gray stone of good quality and susceptible of high polish. Examples of construction: Portions of the New York docks; part of the towers and approaches of the New York and Brooklyn bridge; part of the New York post-office.

GRANITE.—East Boston, Fox island, Maine.

A very fine grained stone, having the general complexion of the Westerly granite, but differing from that by showing a faint pinkish blush in its feldspar. In this respect it resembles the "harbor granite" of Fox island, of which it is indeed only a fine-grained variety.—J. S. N.

GRANITE.—Deer island, Maine. A light gray and biotitic granite. Example of construction: The grain elevator of the New York Central Railroad.

GRANITE.—Vinal Haven, Maine. Light gray and rather coarse. Examples of construction: Sailors' Snug Harbor, Staten island; the Butler monument at the mausoleum in Greenwood cemetery, etc.

GRANITE.—Saint George, Maine. Fine-grained and compact. Example of construction: The pedestal of the La Fayette monument at Union square.

GRANITE.—Augusta, Maine. A compact and fine-grained granite, containing both muscovite and biotite, and capable of receiving a good polish. Examples of construction: Mills' building, corner of Broad street and Exchange place; monument to Recorder Hackett; Roberts tomb in Woodlawn cemetery; Wood's tomb in Greenwood cemetery, etc.

GRANITE.—Biddeford, Maine. Examples of construction: A railroad elevator in Jersey City; docks along the North river, etc.

GRANITE.—Pownal Centre, Maine. Sometimes used for paving in New York city.

GRANITE.—Harbor, Fox island, near Rockland, Maine.

A coarse-grained, handsome mottled granite, composed of very pale pink and white feldspar, mingled with relatively fine grains of quartz and hornblende. Its general tone of color is reddish gray blotched with white, and quite pleasing to the eye. It takes a good polish.—J. S. N.

Examples of construction: Part of the towers of the New York and Brooklyn bridge; the basement of the Stock Exchange building.

GRANITE.—Hallowell, Maine.

A very light, fine-grained stone, consisting chiefly of white orthoclase feldspar, with relatively fine grains of glassy quartz, specks of black hornblende, and minute scales of silvery mica. This latter gives the stone a peculiar glitter and adds greatly to its beauty without seriously affecting its strength. Dressed surfaces are almost as white as white marble, and, where polished, the spangles of mica buried beneath the surface reflect the light and sparkle like diamonds. From the small quantity of quartz and the presence of mica, the Hallowell granite works with usual facility, both in the quarry and under the chisel; yet it takes a good polish and is as strong and will prove as durable as most of the esteemed varieties of this stone.—J. S. N.

Examples of construction: Finish of door-jambs, windows, etc., of Saint Patrick's cathedral, Jersey City heights; Ludlow street jail; the *Tribune* building; the "Halls of Justice" or "Tombs" prison, in Centre street.

GRANITE.—Round Pond, Maine. A dark gray and compact biotitic granite. Example of construction: The Seventh Regiment armory.

GRANITE.—Clark's island, Maine.

GRANITE.—Mount Waldo, Maine.

GRANITE.—Musquito mountain, Maine.

GRANITE.—Jonesboro', Maine. Examples of construction: Part of the panels at entrance of Williamsburg Savings bank, Brooklyn; the front of Welles building, on the corner of Broadway and Beaver streets, New York; the Hunnewell building, etc.

GRANITE.—Frankfort, Maine. A coarse, compact, and generally porphyritic gray biotitic granite. Example of construction: Part of towers and approaches of New York and Brooklyn bridge.

GRANITE.—Mount Desert island, Maine. A light gray biotitic granite. Examples of construction: Part of towers and of the Brooklyn approaches of the New York and Brooklyn bridge; Metropolitan Museum of Art; fort Schuyler, etc.

GRANITE.—Radcliffe's island, Maine. Examples of construction: Bridges in Central park.

GRANITE.—Dix island, Maine. A dark gray, compact granite. This quarry is now exhausted. Examples of construction: New York post-office; first base-course of Saint Patrick's cathedral; court-house in City Hall park; part of *Staats Zeitung* building; fortifications in the harbor; docks at Castle Garden, and the retaining-walls for the basin and barge-office.

GRANITE.—Concord, New Hampshire. Examples of construction: Booth's theater; German Savings bank, corner Fourteenth street and Fourth avenue (basement, Quincy granite); part of towers and approaches of New York and Brooklyn bridge.

GRANITE.—Saint Johnsbury, Vermont.

A gray stone of excellent quality and established reputation.—J. S. N.

GRANITE.—Bethel, Vermont.

A nearly white granite of a homogeneous texture, but not highly polished. It must be an admirable stone for special uses, but it is probably less durable than some of the more siliceous and compact varieties.—J. S. N.

GRANITE.—Barre, Vermont.

This stone has been proved by ample trial to be an excellent stone for architectural and monumental purposes. It is light gray in color, of medium fineness, very homogeneous, and firm.—J. S. N.

GRANITE.—Cape Ann, Massachusetts. Example of construction: The dark base stone and spandrel stones of the towers and approaches of New York and Brooklyn bridge.

GRANITE.—Quincy, Massachusetts.

A well-known stone consisting of quartz, feldspar, and hornblende without mica. The color varies considerably, and affords opportunity for the exercise of taste in combination and adaptation to different purposes. This variation of color is due to differences in the feldspar of the different beds. In one it is pale green, in another purplish-blue, and in the third pale pink. The black hornblende, which exists in considerable quantity, is the same in all, as is also the glassy quartz. The stone is susceptible of a high polish, and its strength and durability are amply attested by the trials to which it has been subjected. As a whole the Quincy granite is rather somber in tone, and on this account is for many purposes less desirable than the lighter varieties.—J. S. N.

Examples of construction: The Astor house; Reformed church, in La Fayette place, corner of Fourth street; custom-house, Wall street, corner of William; part of trimmings of Normal college, and Hahnemann hospital, Fourth avenue and Sixty-seventh street; part of *Staats Zeitung* building; Tryon row, between Center and Chatham streets.

GRANITE.—Westerly, Rhode Island.

This is a remarkably fine grained homogeneous stone, chiefly composed of pale-pinkish or brownish-white orthoclase and thickly set with minute grains of black hornblende and occasional specks of black mica. It takes a fine polish, and is justly esteemed as one of the best granites in the country.—J. S. N.

One variety is decidedly pinkish in color; the others gray, fine, and coarse-grained; all of good quality. Also red, white, and blue varieties. Example of construction: Part of Brooklyn anchorage of the New York and Brooklyn bridge.

GRANITE.—Thomaston, Connecticut.

It is lightest in color of all the granites exhibited at Philadelphia; is fine-grained, compact, and homogeneous, and is a remarkably beautiful and excellent stone, specially adapted to monumental work, for which it is largely used and highly esteemed.—J. S. N.

GRANITE.—Millstone point, Connecticut.

A dark gray granite of fine, homogeneous texture, showing strong contrast of color between polished and dressed surfaces.—J. S. N.

GRANITE.—Leetes island, Connecticut.

It is a reddish-gray, rather coarse-grained gneiss; a handsome building stone, but taking an imperfect polish, and is not well adapted to ornamental purposes.—J. S. N.

Example of construction: Bridge over Harlem river.

GRANITE.—Mystic Bridge, Connecticut.

A very fine grained, light to dark gray granite, homogeneous in texture, and handsome.—J. S. N.

GRANITE.—Stony Creek, Connecticut.

Pale red in color, of medium grain, and consists of flesh-colored orthoclase, greenish-white oligoclase, and glassy quartz, with specks of black hornblende and magnetic iron. Minute points of pyrites may also sometimes be seen in it. It is a strong, compact, and handsome stone, having an agreeable tint, taking a high polish, and has been proved by trial to be well adapted for both construction and ornament.—J. S. N.

Another variety is a gray, fine-grained stone of good quality. Example of construction: Part of New York anchorage of the New York and Brooklyn bridge.

GRANITE.—Umpewaug, Norwalk, Connecticut.

This is a rather fine grained, pinkish gray granite, homogeneous and compact; a good building stone.—J. S. N.

RED GRANITE.—Lyme, Connecticut.

Very coarse grained, composed mostly of pale red or flesh-colored feldspar mottled with a whiter variety and glassy quartz; it is also speckled and streaked with hornblende. From the preponderance of coarsely crystallized pale red orthoclase in its composition, it has a more uniform tint than any other red granite shown in the exhibition, and on this account, should it prove sound and strong, it will be a valuable addition to the varieties now in use for architectural and ornamental purposes.—J. S. N.

GRANITE.—Niantic, Connecticut. Light gray and fine grained. Example of construction: Reservoir in Central park.

GRANITE.—Saint Lawrence county, New York. Derived from the Laurentian formation.

GRANITE.—Cornwall, New York (highlands of Hudson river). Derived from the Laurentian formation.

GRANITE.—Charlottesburg, New Jersey. Example of construction: Part of the New York anchorage of the New York and Brooklyn bridge.

GRAY GRANITE (Aberdeen granite).—Rubislaw, near Aberdeen, Aberdeenshire, Scotland. This occurs in large blocks, takes a fine polish, and is grayish in tint. It is of metamorphic origin, according to Haughton, and consists of quartz, orthoclase, and black mica. The city of Aberdeen is built from it.

GRAY GRANITE (Aberdeen granite).—Rubislaw, near Aberdeen, Aberdeenshire, Scotland. This stone is considered the best granite adapted as pavement for the traffic of London, as it is very durable and less slippery than most other granites. It was used in England in the London pavements, the Portsmouth and Sheerness docks,

Bell Rock light-house, Waterloo bridge, and upper side of London bridge, and in many polished columns and stones of buildings throughout New York city, Brooklyn, etc. Its weight per cubic foot varies from 165 to 166 pounds.

RED GRANITE (Peterhead granite).—Sterling Hill, near Peterhead, 30 miles from Aberdeen, Scotland. This is the best and most beautiful of the granites of Scotland. Its weight per cubic foot is about 166 pounds. It is used in the columns and building stones of numerous edifices in all the cities of Great Britain, where it is justly esteemed for the beauty of its color, closeness of texture, and the large blocks it yields from the quarry. It contains red orthoclase, albite, black mica, and quartz, and has been considered eruptive by Dr. Haughton.

British examples of construction: Pillars of Carlton club-house; the Fishmongers' hall, London. Columns for interior of Saint George's hall, Liverpool. Columns in Provincial Bank of Ireland, Dublin.

The Scotch granites are justly esteemed for their beauty of color and closeness and uniformity of texture. * * * The popularity of the Scotch granites, excellent as they are, is not due however to any superiority over the granites of the United States, but rather to their early occupation and subsequent possession of the market. No stronger or more durable stone is likely to be found anywhere than the granites of Peterhead and Aberdeen, but they do not surpass in beauty or excellence the red granites of the Bay of Fundy and Gananogue, and the more esteemed varieties of red and gray granite from New England.—J. S. N.

Examples of construction in the United States: Many polished columns and stones in the fronts and entrances of many buildings throughout New York, Brooklyn, etc.

SYENITIC GRANITE.—The granite of Syene (syénite rose d'Egypte) occupies large tracts in Upper Egypt between the first cataract and the town of Assuan, the ancient Syene, including several islands both above and below the cataract. It was extensively quarried by the Egyptians as far back at least as the reign of Zestos, king of Thebes, one thousand three hundred years before the Christian era, and fashioned into columns, obelisks, sarcophagi, and colossal statues which have lasted with but little injury down to the present day, and adorn the cities and public galleries of modern Europe. These quarries may still be traced at intervals, and the marks of the pick and chisel are still fresh. * * * It consists of large crystals of red orthoclase, sometimes in twins, and porphyritically developed, a little yellowish oligoclase, quartz, and dark mica, with occasionally a little hornblende. Sometimes the orthoclase crystals are of very large size, and the whole rock extremely coarse grained. The general color of the rock is reddish, and it takes a fine polish.

The analyses of Egyptian granite (or "syenite"), from a fragment of an antique in the collection of the Louvre, Paris, by Professor Delesse, yielded the following results: Silica, 70.25 per cent.; alumina, 16.00; oxides of iron and manganese, 2.50; lime, 1.60; magnesia, potash, and soda, 9.00; water, 0.65. Examples of construction: The obelisk and pedestal in the Central park, New York city. The masonry at the base of the pedestal consists of nummulitic limestone from Egypt.

GNEISS.—New York island. This rock occurs in two common varieties: the one biotitic, fine-grained, often slaty, bluish-gray in color, and consisting of quartz, plagioclase, feldspar, biotite, with more or less garnet, magnetite, fibrolite, etc.; the other, hornblendic, black, glistening, slaty, and differing from the former chiefly in a large content or predominance of black hornblende. Examples of construction: The foundations of most of the buildings of the city; side walls of Saint Paul's church, corner of Broadway and Fulton street; church, Thompson street near Prince; Church of the Strangers, Mercer street, near Clinton place; All Saints church, Henry street, near Scannel street; Henry Street church, Henry street, near Market street; church, Henry street, near Rutgers street; church, Centre street, corner of Broome; basement of Irving hall, on southwest corner of Irving place and Fifteenth street; church, Twentieth street, west of Eighth avenue; church, Twenty-third street, east of Third avenue; Bellevue hospital, Twenty-seventh street, east of First avenue; church on southeast corner Thirty-eighth street and Madison avenue; asylum for the blind, Thirty-third street, near Ninth avenue; church, Thirty-fourth street, east of Seventh avenue; church, Madison avenue, near Thirty-eighth street; church, Forty-fourth street, east of Tenth avenue; church, northeast corner of Forty-seventh street and Madison avenue; church, Fifty-third street, east of Sixth avenue; church, Seventy-second street, near Third avenue; church, Seventy-fourth street and Fourth avenue; church, One hundred and seventeenth street, near Fourth avenue; church, One hundred and twenty-seventh street, near Lexington avenue; part of church of the Holy Spirit, corner Sixty-sixth street and Madison avenue; first story of Berkshire building, on northwest corner of Fifty-first street and Madison avenue; basement of New York foundling asylum, on southwest corner Third avenue and Sixty-ninth street; New York Juvenile Asylum, One hundred and seventy-eighth street (Kingsbridge road); Saint Ann's Avenue church, One hundred and fortieth street; church, Third avenue, near One hundred and forty-sixth street; Saint John's college, Fordham; cemetery office, Woodlawn; Methodist church, Washington place; church on northwest corner Washington place and Sixth avenue; Croton aqueduct, and the reservoirs at Fifth avenue and Forty-second street, and in Central park (quarried from site); Church of Saint Paul the Apostle, Ninth avenue and Fifty-ninth street (facings, red Connecticut granite); foundations of the Lenox hospital, Seventieth street and Madison avenue; basement of the Berkshire building, northwest corner of Madison avenue and Fifty-second street; the tower, bridges, and walls in Central park.

GNEISS.—Westchester county, New York. Examples of construction: Many bridges and walls in Central park.

GNEISS.—Willett's Point, Kings county, New York (Long island, on the shore of the sound). Examples of construction: Fort Schuyler, at Throgg's Neck, Long island. In Brooklyn: Church, State street, west of Bond street; church, Carroll street, south of Court street; church, Marcy avenue; naval hospital, near Harrison avenue; church, Fourth street, near Broadway; church, Kent street, east of Franklin avenue.

MARBLE.—Swanton, Vermont.

All the Swanton marbles have the excellencies and defects of those of Mallett's head—that is, they are hard and somewhat difficult to work, but take a proportionately fine polish, which they retain longer than softer stones. The mistake is frequently made of using these mottled, veined, and brecciated marbles for tiling, but this sort of wear speedily betrays the difference in hardness of the several parts and destroys their beauty; hence economy as well as good taste will be consulted by using for steps, thresholds, tiling, etc., the monochrome marbles only.—J. S. N.

Examples of construction. (See below.)

STATUARY MARBLE.—West Rutland, Vermont. Brilliant, white, somewhat tender and absorbent, and hence best fitted for use when it is not exposed to the weather. Similar marbles are also brought from Rutland Centre, Dorset, Danby, Pittsford, Brandon, Shelburne, and Middlebury, Vermont. Examples of construction. (See below.)

MARBLE.—Manchester, Vermont. A rather coarse, white stone, streaked or clouded with black or gray. Examples of construction: Building of Drexel & Morgan, corner of Wall street and Broadway, New York; Dutch Reformed church, corner of Twenty-ninth street and Fifth avenue.

MARBLE.—Sutherland Falls, Vermont.

General examples of construction in Vermont marbles: The Sutherland building, southeast corner of Sixty-third street and Madison avenue (beginning to be discolored by iron stains, chiefly derived from iron work); Savings Institution building on southeast corner of Clinton street and Atlantic avenue, Brooklyn. The latter building shows streaks of discoloration on moldings of cornices, etc.

WINOOSKI MARBLE.—Mallett's head, on Isle La Motte, in lake Champlain, near Burlington, Vermont.

It is mottled red, white, and brown, a hard stone, and somewhat difficult to work, but takes a high polish, and is very strong and durable. There is considerable variety in the tint of the Winooski marble, produced by the relative preponderance of the colors mentioned, and the size of the figure, some slabs being coarsely mottled with white and brown, others chocolate and pale red, and others still light red, speckled, and mottled with white.—J. S. N.

Examples of construction: The reredos of Grace church, Broadway, between Tenth and Eleventh streets, New York.

MARBLE.—Isle La Motte, Vermont.

These marbles are dark gray and black; the latter is less deep in color than the Glens Falls and Lyecoming black marbles, but is harder and stronger. It is largely used for tiling in combination with white marble or slate; for this purpose it has been in use for twenty-five years, proving itself to be an exceedingly durable and serviceable stone. The "fine gray" and "coarse gray" are valuable building stones.—J. S. N.

MARBLE.—Lee, Massachusetts.

The Lee marble is for the most part of a uniform though not brilliant white color, is coarser grained than the Vermont marbles, and yet finer than those of New York. It is a strong and durable stone, but contains a little iron, by the oxidization of which it becomes somewhat brown on exposure. It is doubtful whether its strength and durability are materially impaired by this, and the change of color which it produces is by some architects regarded as an excellence rather than a defect.—J. S. N.

It usually contains a little pyrites, but is a remarkably white marble. Example of construction: Saint Patrick's cathedral, Fifth avenue and Fiftieth street.

MARBLE.—West Stockbridge, Massachusetts.

It is similar in character to that from Lee, resembling coarse loaf-sugar.—J. S. N.

Examples of construction: The east, south, and west fronts of the old city hall, New York; the Treasury building in Wall street.

MARBLE.—Canaan, Connecticut.

It varies somewhat in color and texture, some of it being very white and of fine grain, and well adapted to monumental purposes; the greater part, however, is bluish-white or mottled. This is harder to work, more durable, and best suited for building.—J. S. N.

MARBLE.—Glens Falls, New York.

This is a very dark phase of the Trenton limestone. It has been little, if at all, metamorphosed, and is simply a hard limestone impregnated with carbonaceous matter, to which it owes its color. It is less hard and black than the most esteemed black marbles, but serves an excellent purpose for tiling, and is sometimes used for mantles and other interior decorations. Like all the black limestones, it will be found to lose its color and become gray by exposure to the weather.—J. S. N.

MARBLE.—Lockport, New York. (Already mentioned under Limestone.)

MARBLE.—Hastings, New York. Example of construction: The University building, University and Waverly places, often spoken of as "white granite".

MARBLE.—Tuckahoe, New York.

The quarries which furnish the Tuckahoe marble are located on one of the several belts of crystalline dolomite which traverse, with a north-northeast and south-southwest bearing, the country north of the city of New York. Of these, one reaches New York island, crossing the Harlem river at Kingsbridge; another outcrops on the sound, near New Rochelle; still others strike the Hudson above New York, at Hastings, Dobbs ferry, Sing Sing, etc. Several of these furnish good marble for building stone—gray, blue, or white—but none that is fine for decorative purposes. The best marbles yet obtained from these series of deposits are those of Tuckahoe and Pleasantville. The Tuckahoe marble is pure white in color, and much coarser in texture than any of those hitherto noticed. It is somewhat irregular in quality, but the better grades are highly esteemed for architectural purposes, and have been used in some of the finest buildings in the city of New York. * * * By exposure in the impure atmosphere of the city, its color changes to a light gray. This is apparently due to coarseness of texture, which gives a roughness to the surface and causes the smoke and dust to adhere to it more closely than they would to a finer stone.—J. S. N.

Examples of construction: The residence on the northwest corner of Thirty-fourth street and Fifth avenue; part of Saint Patrick's cathedral, Fiftieth street and Fifth avenue; the Stock Exchange building, and the New York Life Insurance building.

SNOWFLAKE MARBLE.—Pleasantville, Westchester county, New York.

The dolomite belt in which the Pleasantville marble quarries are situated is one of the broadest known, being more than half a mile in width. It consists chiefly of beds of impure dolomite, white or banded, which contain too much siliceous matter to be available for building or ornamental purposes, with some layers, often of considerable thickness, of pure white marble, in part similar to that of Tuckahoe, and partly still more coarsely crystallized. The beds are more or less interstratified with layers of granite and gneiss, the whole series standing nearly on edge among the marble layers in this locality; the most conspicuous and valuable is that which is worked by the Pleasantville Land Company, and which furnishes the "snowflake marble". This belt is about 400 feet wide, standing vertical, and consists throughout of pure white dolomite, almost without cloud or stain, and with no foreign matter.—J. S. N.

This stone weathers well in New York, but is apt to become stained, especially under window-sills. Examples of construction: The greater part of Saint Patrick's cathedral, New York; Union Dime Savings bank, Thirty-second street, between Sixth avenue and Broadway.

General examples of construction in Westchester marble: Block of houses on east side of Fifth avenue, between Fifty-seventh and Fifty-eighth street; the National Academy of Design, Fourth avenue and Twenty-third street; city hall, Brooklyn; court-house and municipal building; (?) Grand opera house, Eighth avenue and Twenty-third street; (?) church on northeast corner of Twenty-first street and Fourth avenue; Stewart's store buildings, Broadway, between Chambers and Reade streets, and between Ninth and Tenth streets; many store buildings in Chambers, Warren, Murray, and Barclay streets, Park place, etc.; the United States hotel, corner of Fulton and Pearl streets.

MARBLE.—Williamsport, Lycoming county, Pennsylvania. The "ebony marble" from this locality is one of the most beautiful of American black marbles.

It is a jet-black stone, not quite equal to the Belgian black in purity of color and hardness, but it is very black, and takes a brilliant polish. It contains a few specks of pyrites, and here and there a hair-line ring of white, marking the section of a fossil; but it works with great exactness, and seems to be an excellent, as it certainly is a handsome, stone.—J. S. N.

MARBLE.—Knoxville, Tennessee.

This is a highly-crystalline, compact, and hard marble, which varies in tint from brown to pink, but is not mottled, the color being distributed in sheets and belts, so that blocks of considerable size can be taken out, which are of nearly a uniform shade. Usually the color is pinkish-brown, traversed by lines of blue. It is free from cracks and flaws, and takes a very uniform and brilliant polish.—J. S. N.

Examples of construction: Ninth National Bank building; Park National Bank building; Grand Central hotel; Oiseo building, etc.

MARBLE.—Doughertyville, Tennessee.

The prevailing tint of the Tennessee marble is chocolate, mottled with pure white, and is very pleasing to the eye. It is also commended by marble-workers as being sound and strong, and it takes, for a variegated marble, a high and uniform polish.—J. S. N.

MARBLE.—Carrara, Tuscany, Italy. Derived from the Jurassic, Trias, and Oolite.

The best quarries are opened along both sides of a deep valley, in which the village of Carrara is situated, and along which flows the Torano. In general the marble has a light bluish hue, or is white with bluish veins, such kinds being generally sawed into slabs at the numerous cutting and polishing mills situated along the course of the stream. The purer varieties, which are perfectly white, crystalline, and free from flaws, are quarried in blocks, sometimes 10, 12, or 14 feet in length, for statuary purposes, and drawn on strong wagons by teams of bullocks down to the railway station at Carrara.—Hull.

Its weight per cubic foot is 168.6 pounds. Examples of construction are abundant in mantels and interior decoration throughout our cities, and in the tombstones in Greenwood, Trinity, and Calvary cemeteries.

TRAP.—Palisades at Jersey City heights, Weehawken, etc., in Hudson county, New Jersey. Examples of construction: Stevens' institute, Hoboken, New Jersey, and the court-house and Saint Patrick's cathedral, Jersey City heights.

TRAP.—Graniteville, Staten island, New York. This is quarried almost entirely for pavements in the cities, and the refuse is crushed up to macadamize roads.

NORWOOD STONE.—Closter, New Jersey. Example of construction: Grace Episcopal church, One hundred and sixteenth street, near Third avenue.

SERPENTINE.—Hoboken, New Jersey. Examples of construction: Many private residences south of Stevens' hill; the wall facing part of the walk along the river; sewers and underpinnings, etc., throughout Hoboken.

SERPENTINE.—Chester, Pennsylvania. This stone is cheap and durable, and hardens by exposure.

This is a well-known coarse green building stone, quite largely used in Philadelphia and elsewhere. * * * It almost immediately assumes the appearance of age, which comports well with certain kinds of architectural design, and with the purposes of certain structures. It is also used in combination with other materials (brick and stone) with good effect, so that it adds an important element to the resources of our architects. The color is yellowish-green, it works with great facility, is fire-proof, and is probably durable.—J. S. N.

Examples of construction in serpentine and serpentine marble: Trimmings of synagogue on the southeast corner of Lexington avenue and Sixty-third street; arches in Saint Bartholomew's church, Madison avenue and Forty-fourth street.

B. PUBLIC BUILDINGS AND IMPROVEMENTS.

Many examples have been given of the common private edifices in whose construction the several varieties of building stone have been employed in this district, often, however, according to the caprice of owners and the hasty choice of architects. In the construction of many of the larger buildings, however, *e. g.*, asylums, hospitals, etc., the sunken portion of the Hudson railroad, as well as in the public edifices, more care and judgment seem to have been often exercised, and more interest is attached to the selection of materials in these cases.

1. PUBLIC BUILDINGS.—More or less reference has already been made to the materials used in the construction of the United States buildings, *e. g.*, the post-office, custom-house, barge-office, etc., and further details are given below of the character of construction in the fortifications of the bay and sound, in their approaches to the city.

It is sufficient to state in reference to other public buildings that their usual materials are given below, viz:

Prisons, bridges in parks and over the Harlem river—sandstone, limestone, granite, and gneiss.

The sewers—gneiss from the island and vicinity, and boulders of a large variety of rocks derived from the excavations in glacial drift.

The Croton aqueduct, the high bridge over the Harlem river, and the reservoirs in the Central park and Prospect park, and at Forty-second street, New York city—granite from New England and gneiss from the island.

2. THE CENTRAL PARK.—In the report of the superintending engineer of the Central park for the year 1862 the following facts are given concerning the distribution of different building stones in the inclosing-walls, bridges, etc., within this park.

Freestone from Albert quarry, New Brunswick (also walls, etc., in Prospect park, Brooklyn); from Dorchester and Weston, New Brunswick, and from New Jersey—vertical wall and bridges.

Brown sandstones from base of Palisades, New Jersey—part of vertical wall.

Mountain graywacke and blue-stone from Hudson river, New York—part of vertical wall.

Limestone from Mott Haven and from Greenwich, Connecticut—part of vertical wall; granite from Radcliffe's island, Maine—bridges; gneiss, in park, bridges and retaining-wall, and lower portion of vertical wall; gneiss and white marble from Westchester county, New York—bridges.

3. FORTIFICATIONS.—Fort Richmond: granite from Dix island, Maine; fort Lafayette: brown sandstone (New Jersey); the fortifications at Willett's point: granite from Spruce Head, Maine; fort Schuyler (on Throgg's Neck): gneiss; fort Wadsworth, on Staten island, fort Hamilton, and fort Diamond are of Maine granite, as are also the defenses on Governor's, Bedloe's, and Ellis islands.

4. NEW YORK AND BROOKLYN BRIDGE.—I am indebted to Mr. F. Collingwood, the engineer in charge of the New York approach, for the following statistics, which have been compiled from his letters:

Materials used.—Granite, from the following localities: Frankfort, Maine; Concord, New Hampshire; Spruce Head, Maine; cape Ann, Massachusetts; Hurricane island, Maine; Westerly, Rhode Island; East Bluehill, Maine; Stony Creek, Connecticut; Mount Desert island, Maine, and Charlottesburg, New Jersey. Limestone, chiefly from Rondout and Kingston, New York; also, from Isle La Motte and Willsborough point, lake Champlain; and from near Catskill, New York.

Distribution.—In the anchorages the corner-stones, exterior of cornice and coping, and the stones resting on anchor-plates consist of granite from Charlottesburg and Stony Creek, in the New York anchorage, and from Westerly, in the Brooklyn anchorage. The rest of the material is entirely limestone, partly from Rondout, largely from lake Champlain. In the towers limestone was chiefly employed below the water-line, and, above it, granite from all the localities named, except Charlottesburg, Westerly, and Stony Creek. In the approaches the materials were arranged in about the same way as in the towers.

Total quantities.—The amounts of granite and limestone employed are estimated in round numbers as follows:

	Cubic yards.	Authority.
Anchorage.....	10,000	F. Collingwood.
Towers.....	85,159	E. E. Farrington.
Approaches.....	21,000	F. Collingwood.

In addition to the hewn stone considerable quantities of rubble were employed from various sources, but largely from Greenwich, Connecticut.

Selection.—The reasons for selection were the following: first, soundness, in regard to durability, and freedom from iron; second, color; third, price, with reference also to facilities for prompt delivery. As a rule all the cornices, parapets, and other cross-cut work and band-courses were required to be light in color. The granite for these was largely from East Bluehill; also from Westerly, Stony Creek, etc. On the contrary, base stones and spandrel stones were required to be dark. For these granite from cape Ann, etc., was used. The limestone was employed partly for cheapness and partly on account of greater specific gravity, as weight was desirable at the base of the towers and in the anchorages.

Strength.—Tests were made at the bridge works by Mr. Probasco on a number of samples of stones, in blocks 2 inches square, or with about 4 square inches of surface, with the following results:

Kind of stone.	Locality.	Position.	Crushing weight per square inch.
Granite.....	Frankfort, Maine.....	On bed.....	18,026
Do.....	do.....	Not on bed.....	15,700
Do.....	Spruce Head, Maine.....	On bed.....	14,200 to 15,875
Do.....	East Bluehill, Maine.....	do.....	12,125 to 16,250
Do.....	Long Cove, Maine.....	do.....	14,040
Do.....	Concord, New Hampshire.....	do.....	17,550
Syenite.....	Cape Ann, Massachusetts.....	do.....	12,861 to 19,280
Do.....	do.....	Not on bed.....	17,875
Granite.....	Quincy, Massachusetts.....	On bed.....	18,000 to 19,000
Do.....	Millstone point, Connecticut.....	do.....	17,425 to 17,550
Sandstone.....	Medina.....	Not on bed.....	11,880
Blue-stone.....	Hudson river.....	On bed.....	9,000 to 13,000
Do.....	do.....	Not on bed.....	11,432
Limestone.....	Kingston, New York.....	On bed.....	13,750 to 15,550

[These figures have been incorporated in Table II.]

5. ROOFS, PAVEMENTS, AND SIDEWALKS.—*Roofs.*—Slate is very largely used for most roofs having a steep pitch. Many varieties are used, which are mainly derived from the following localities: Purple and green—Poultney, Castleton, and Fairhaven, Vermont; red—Middle Granville, New York, and Slatington, Lynnport, Bethlehem, etc., Pennsylvania.

Pavements.—The streets of these cities are mainly paved with stone, many experiments having been made, particularly in New York, in reference to the selection both of the best material and most satisfactory shape. It is a well-known fact that Broadway tests pavements more severely perhaps than any other street in the world.

For cobble-stone pavement bowlders and large pebbles from the till of the island are employed. It is found that the pointed ends of the cobble-stones, lying downward, have a tendency to sink unequally under heavy pressure, and that consequently hollows form in the pavement, rendering the roadway impassable.

The Russ pavement was first laid about the year 1853. It becomes smooth and slippery by uninterrupted travel. It consists of large square granite blocks, sometimes grooved, and answers temporarily, but the grooves are found to wear smooth at their edges. An attempt to groove the blocks already laid down led to the discovery that—

The surface of these stones had, by constant rubbing with iron horseshoes and wheel-tires, aided by atmospheric action, undergone such a physical (or chemical) change that the hardest steel tools could not cut the grooves, and the effort had to be abandoned. (a)

In order to increase the durability of the Russ pavement it was constructed in two layers in some portions of Broadway, the lower consisting of large, irregular, angular pieces of rock laid in the earth. Elsewhere large flag-stones were laid below, then a layer of earth, and then the large blocks of trap or granite. However, the result was unsatisfactory. The whole of the pavement has been broken up, and the blocks split into smaller cubical pieces for use in Belgian pavement elsewhere.

The stones for these [Belgian] pavements are obtained across the Hudson, where the range of basaltic rocks overlying the new red sandstone, and forming the eastern boundary of the state of New Jersey, contains many quarries. The Palisades, one of the natural wonders of the neighborhood, is a perpendicular range of basalt rocks from 300 to 600 feet high, forming the western bank of our beautiful river for a distance of some 20 miles. They are, in fact, a series exposed by nature, and the quarrying is going on so extensively there that some papers have expressed the fear that these picturesque walls will be destroyed; but a simple calculation shows the mass of basalt to be so immense that it would require several thousand years of constant labor at the present rate to make any great change in the outline. There is paving stone enough there for all the streets of New York, Brooklyn, Williamsburg, Jersey City, Hoboken, Hudson City, in short of the future great metropolis, covering several hundred square miles, and yet leave enough of the Palisades to be about as much of a natural curiosity as they are now. (b)

Still later, in place of basalt, a very hard kind of granite has been substituted, from the highlands of the Hudson, cut in flat blocks 10 by 12 inches square and $4\frac{1}{2}$ inches thick, set edgewise, with longest dimension across the line of travel. "The pavement when laid looks much like a brick wall composed of very large gray bricks." This form appears more satisfactory in use than any previously employed. This has been also laid down in Atlantic and Myrtle avenues, Brooklyn.

Wood, concrete, and asphalt have been also used, in various combinations, on many of the streets, but in New York with little success, on account of the heavy wear to which they have been exposed; in Brooklyn the results have been more satisfactory. An enormous amount of trap, however, has been crushed and broken for use in macadamizing, and is still so employed in the upper avenues of New York island and in many of the streets in the

a *Manufacturer and Builder*, 1869, I, 194.

b *The Manufacturer and Builder*, 1869, I, 194; also 1874, VI, 157.

Twenty-third and Twenty-fourth wards; in many avenues and side-streets on the outskirts of Brooklyn, Jersey City, and Hoboken, and many of the streets and roads on Staten island. For this purpose the supply of material is inexhaustible.

Some idea of the quantity and cost of the stone and other materials that have been consumed in New York city for this object, may be deduced from the following estimate, made in 1874:

	Miles.	Cost per square yard.
Macadam (Guidet improved)	22	\$6 06
Granite (granite block on trap).....	26	2 70
Trap-block	180	2 40
Wood	14	5 00
Cobble	83	58
Concrete, asphalt, etc.....	3	3 50
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Sidewalks.—All the sidewalks of New York city are paved with stone, chiefly flag-stone, and this predominates in Brooklyn and the adjacent cities. The following materials are used for paving:

Bluestone or flagging, which is brought by water from the various points along the Hudson river, and by rail from the interior of the state, the Catskill mountains, and from Pennsylvania. The principal localities have been already mentioned among the building stones, under the heading of "Blue-stone". It is used both with its natural surfaces of cleavage, and, in the the larger blocks, with its surfaces planed by machinery.

Huge hewn slabs of several varieties of granite have been largely introduced into the pavements of large business streets, especially of Broadway, within a few years. Notwithstanding their roughly-dressed or picked surfaces, they are very objectionable on account of their slipperiness when wet or when covered with coatings of ice and slush.

Mica-slate, from Bolton, Connecticut, etc., was formerly used in considerable abundance, before the development of the quarries of blue flagging. It is a white, glistening, schistose rock, resisting well the weather and ordinary travel; but was mostly laid down in small blocks, whose edges and corners were first abraded or became broken by hard or long-continued wear, the material on the whole being too soft and slippery for this use. Examples of it may still be found in the following streets, though it is being fast taken up for replacement by blue flagging: Along West Nineteenth street, in La Fayette place, between Astor place and Great Jones street; along Clinton and Waverly places; in Liberty street, near Greenwich street, etc.

Gneiss, from Haddam, Connecticut, also, like the preceding, was considerably used in the early history of the city. It was laid down in small square stones, about 18 inches square, with a very rough surface, and was used both for pavement and for coping. Probably much of the gneiss from New York island and from Willett's point was once employed for this purpose.

Examples of these sidewalks may yet be found in several of the old and narrow streets below Pearl, *e. g.*, Pine street, etc.

The curbstones in New York and adjacent cities consist entirely of stone, chiefly flag-stone, but in part hewn blue-stone and granite, from the localities above mentioned.

An approximate idea of the prevailing market prices, chiefly in the year 1882, of the stones more commonly employed may be derived from the following table. The prices refer to the rough stone, per cubic foot, as delivered on the dock in New York city:

SANDSTONE.

Locality.	Color.	Price per ton.	Price per cubic foot.	Remarks.
Springfield, Massachusetts	Red and brown	\$11 00		
Venice	Brown	25 00		
Portland, Middlesex county, Connecticut.....	do		\$1 00 to \$1 50	
Middletown, Connecticut	do		1 50	
Belleville, New Jersey	do	\$1 00 to \$1 75	1 00 to 1 50	
Newark, New Jersey	do		1 00 to 1 50	
	do	15 00	1 05 to 1 30	1874.
	Drab		1 00 to 1 10	
Dorchester, New Brunswick.....	Olive		1 00	
	Yellow		1 00 to 1 07	
	Brown	15 00	90 to 1 10	
Mary's Point, New Brunswick.....	Salmon	15 00		
	Olive	13 00		
Wood Point, New Brunswick.....	Brown	14 00	1 00 to 1 10	
	Red	12 00	1 05	
Wallace, Nova Scotia.....			1 00	
	Brown			
Kennetcook, New Brunswick.....	Olive	13 00		
	Blue	13 00		

SANDSTONE—Continued.

Locality.	Color.	Price per ton.	Price per cubic foot.	Remarks.
Berlin Heights, Ohio.....	{ Buff or yellow.....	.....	\$0 08 to \$1 00	To \$1 20, 1874.
	{ White.....	.....	1 00	
New Amherst, Ohio.....	{ No. 1 buff.....	.....	95 to 1 05	To \$1 20, 1874.
	{ No. 1 blue and light drab.....	.....	80 to 95	
Cleveland, Ohio.....	{ White.....	.....	90 to 1 00	
	{ Blue.....	.....	1 00	
Independence, Ohio.....	.....	.....	1 10	
Buena Vista, Ohio.....	.....	.....	1 55	
Cincinnati, Ohio.....	.....	.....	1 00	
Berea, Ohio.....	.....	.....	1 00	Varied 85 cents to \$1 15.
Carlisle, England.....	Red.....	.....	1 00 to 1 10	
Corsehill, Scotland.....	do.....	.....	1 00 to 1 05	

LIMESTONE.

Ellettsville, Indiana.....	.....	.....	\$1 25	
Caen, France.....	.....	.....	1 50	
Bedford, Indiana.....	.....	.....	1 25	

MARBLE.

Westchester county, New York.....	.....	.....	\$1 50	
Canaan, Connecticut.....	.....	.....	\$1 55 to 1 70	1876.
Sutherland Falls, Vermont.....	.....	.....	1 25 to 1 75	

GRANITE.

Millstone point, Connecticut.....	.....	.....	\$0 00	
Roxbury, Connecticut.....	.....	.....	\$0 65 to 1 25	
Quincy, Massachusetts.....	.....	.....	2 00	
Westerly, Rhode Island.....	.....	.....	1 50	
Mount Waldo, Maine.....	.....	.....	00	
Clark's island, Maine.....	.....	.....	75	
Spruce Head, Maine.....	.....	.....	00	
Round Pond, Maine.....	.....	.....	1 50	For stones 20 feet and under.
Granite (hammered).....	.....	About \$16 50	1 00 to 1 50	

GNEISS.

Foundation stone (rubble).....	.....	.....	\$0 08 to \$0 10	
Building stone, per load.....	.....	.....	2 00 to 3 00	

BLUE-STONE AND FLAG-STONE.

Wilbur, Ulster county, New York.....	{ Bluestone.....	.....	\$0 70 to \$1 50	For sills, lintels, etc.
	{ do.....	.....	07 to 1 00	For copings (per yard).
Kingston, Ulster county, New York.....	do.....	.....	09 to 3 50	
Smithville, Chenango county, New York.....	do.....	.....	1 25	
Skinner's Eddy, Wyoming valley, Wyoming county, Pennsylvania.....	do.....	.....	1 00 to 1 50	
Wyoming valley, Meshoppen, Wyoming county, Pennsylvania.....	do.....	.....	1 50	

FLAG-STONE.*

Length in feet.	Thickness, inches.	Per square foot, cents.
3	2	3
4	2	4
5	2	3½
6	2	6½
8	4	10 to 12

* Pond Eddy, Lackawaxen, etc., Pike County, Pennsylvania; retailed at 15 cents to \$1 50 per square foot.

ROOFING SLATE.

	Per square foot.
Purple or green.....	\$7 00 to \$8 00
Red.....	15 00
Black (Pennsylvania).....	4 75 to 5 25

STONE CONSTRUCTION IN CITIES.

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STATISTICS OF BUILDINGS (NUMBERS AND MATERIALS) IN NEW YORK CITY AND BROOKLYN.

Material.	NEW YORK CITY.				BROOKLYN.			
	District of wholesale business houses.	District of small stores and ten- ments.	District of large stores and resi- dences.	Entire city.	District of ware- houses, ten- ements, etc.	District of residences and small stores.	District of small resi- dences, Long Island city.	Entire city.
Freestone:								
Brown sandstone.....	566	1,598	6,979	9,143	225	6,377	4	6,606
Nova Scotia sandstone.....	237	88	725	1,050	167			167
Ohio sandstone.....		47	139	186				
Foreign sandstone.....			13	13				
Artificial.....							10	10
Limestone.....			3	3	1	1		2
Blue-stone.....			5	5				
Granite.....	149	9	40	204		3		3
Gneiss.....	3	40	61	104		18	5	23
Marble.....	686	10	272	918	7	87		94
Brick.....	8,515	20,457	34,157	63,129	5,601	23,581	211	29,430
Stucco.....	5	23	166	194	51	587		638
Iron.....	356	85	460	910	3	67		70
Frame.....	590	10,360	13,384	24,334	3,926	33,556	948	38,430
Total.....	11,057	32,717	56,410	100,183	9,904	64,444	1,178	75,526
Buildings with stone fronts.....				11,574				6,880
Buildings constructed almost entirely of stone.....				52				25
Total stone.....	1,591	1,792	8,243	11,626	233	6,653	10	6,905
Total brick and stucco.....	8,520	20,480	34,323	63,323	5,742	24,168	211	30,121

STATISTICS OF BUILDINGS (NUMBERS AND MATERIALS) IN THE SUBURBS AND IN THE ENTIRE METROPOLIS.

Material.	STATEN ISLAND.	JERSEY CITY.			HOBOKEN.				New York city and its suburbs.
	Castleton, etc. (Staten Isl- and).	Jersey City proper, in- cluding Hud- son City and Bergen city.	Bayonne and Greenville.	Entire city.	Hoboken proper.	West Hobo- ken and town of Union.	Weehawken.	Entire city.	
Freestone:									
Brown sandstone.....	8	294	38	332	121	21		142	10,231
Nova Scotia sandstone.....	3	4		4	7			7	1,231
Ohio sandstone.....		15		15					201
Foreign.....									13
Artificial stone.....									10
Limestone.....									10
Blue-stone.....									215
Granite.....	4	4		4					153
Gneiss.....	15	3		3	7	1		8	1,027
Marble.....	12	3		3					63
Trap.....		8	50	58		5		5	
Brick.....	716	4,441	224	4,665	1,708	174	31	1,913	99,006
Stucco.....	16	96		112	136	5		141	1,085
Iron.....		8		8					688
Frame.....	6,951	12,656	3,036	15,692	1,518	2,452	98	4,068	80,475
Total.....	7,725	17,532	3,348	20,880	3,407	2,658	129	6,284	210,609
Buildings with stone fronts.....	40	331	88	419	135	27		162	19,075
Entirely of stone.....	2								79
Total stone.....	42	331	88	419	135	27		162	19,154
Total brick and stucco.....	732	4,537	224	4,761	1,844	179	31	2,054	100,991

BUILDING STONES AND THE QUARRY INDUSTRY.

STATISTICS CONCERNING THE PHYSICAL PROPERTIES OF THE BUILDING STONES USED IN NEW YORK CITY.

GRANITE.

Kind.	Locality.	Size of cube in inches.	Position.	Number of trials.	COMPRESSIVE STRENGTH PER SQUARE INCH.	
					Range.	Average.
					<i>Pounds.</i>	<i>Pounds.</i>
Red.....	Bay of Fundy, Canada.....	2	Bed.....	2	11,812 to 12,020	11,916
Do.....	do.....	2	Bed.....	1	.....	17,500
Do.....	do.....	2	Edge.....	1	.....	18,750
Do.....	Fox island, Maine.....	2	.....	2	11,700 to 14,875	13,287
Do.....	do.....	2	Bed.....	1	.....	15,062
Do.....	do.....	.....	.....	.....	11,892 to 14,185	.....
Do.....	Dix island, Maine.....	2	.....	1	.....	15,000
Do.....	do.....	.....	.....	.....	24,000	.....
Do.....	Spruce Head, Maine.....	2	.....	2	13,500 to 17,500	15,500
Do.....	do.....	2	Bed.....	.....	14,200 to 15,875	.....
Do.....	do.....	2	Bed.....	2	11,000 to 14,425	12,712
Gray.....	Hurricane island, Maine.....	2	Edge.....	1	.....	14,937
Do.....	Palmer quarry, Maine.....	.....	.....	.....	.....	.....
Do.....	Jonesboro', Maine.....	.....	.....	.....	11,233 to 15,952	.....
Light.....	Harbor quarry, Maine.....	2	Bed.....	2	10,218 to 13,837	10,527
Do.....	East Bluehill, Morgan's bay, Maine.....	2	.....	.....	.....	17,200
Do.....	East Bluehill, Maine.....	2	Bed.....	.....	12,125 to 16,250	.....
Light gray.....	East Boston, Maine.....	2	Bed.....	2	10,031 to 18,000	17,015
Do.....	City Point, Maine.....	.....	.....	.....	.....	.....
Do.....	Frankfort, Maine.....	2	Bed.....	1	.....	18,026
Do.....	do.....	2	Edge.....	1	.....	15,700
Do.....	Carver's quarry, Maine.....	.....	.....	.....	.....	.....
Do.....	Long Cove, Maine.....	2	Bed.....	1	.....	14,040
Do.....	Wharf quarry, Maine.....	.....	.....	.....	.....	.....
Do.....	K., W. & Co.'s quarry, Maine.....	.....	.....	.....	.....	.....
Do.....	Concord, New Hampshire.....	.....	.....	.....	8,812 to 9,838	.....
Do.....	do.....	2	Bed.....	1	.....	17,550
Dark.....	Quincy, Massachusetts.....	2	.....	.....	.....	17,750
Do.....	do.....	2	Bed.....	.....	18,000 to 19,600	.....
Do.....	do.....	.....	.....	.....	.....	9,739
Do.....	do.....	.....	.....	.....	11,730 to 15,622	.....
Light.....	do.....	2	.....	.....	.....	14,750
Gray or mottled.....	do.....	2.2 to 2.9	.....	2	12,390 to 15,920	.....
Do.....	Quincy, Massachusetts (Wigwam quarry).....	1.5	.....	3	.....	29,330
Do.....	Cape Ann, Massachusetts.....	2	Bed.....	2	12,423 to 19,500	15,961
Do.....	do.....	2	Bed.....	.....	12,861 to 19,280	.....
Syenite.....	do.....	2	Edge.....	.....	.....	17,875
Do.....	do.....	2	Bed.....	1	.....	16,300
Gray.....	Rockport, Massachusetts.....	2	Edge.....	1	.....	19,750
Do.....	do.....	.....	.....	.....	.....	15,296
Old quarry.....	Westerly, Rhode Island.....	2	.....	2	17,250 to 17,750	17,500
Do.....	do.....	2	Bed.....	1	.....	14,687
Gray.....	do.....	2	Edge.....	1	.....	14,937
Do.....	do.....	.....	.....	.....	15,501 to 18,778	.....
Do.....	Millstone point, Connecticut.....	2	.....	2	16,187 to 18,750	17,468
Do.....	do.....	2	Bed.....	.....	17,425 to 17,550	.....
Do.....	Greenwich, Connecticut.....	2	.....	2	11,300 to 11,700	11,500
Do.....	Plymouth, Connecticut.....	.....	.....	.....	8,020 to 10,412	.....
Niantic river.....	New London, Connecticut.....	2	.....	1	.....	12,500
Do.....	do.....	2	Edge.....	1	.....	14,175
Porter's rock.....	Mystic River, Connecticut.....	2	Bed.....	1	.....	18,125
Do.....	do.....	2	Edge.....	1	.....	22,250
Do.....	do.....	2	Bed.....	2	15,000 to 15,750	15,375
Gray.....	Stony Creek, Connecticut.....	2	Edge.....	1	.....	16,750
Do.....	Tarrytown, New York.....	2	Bed.....	1	.....	18,250
Flagging.....	Hudson river, New York.....	2	.....	1	.....	18,425
Do.....	do.....	2	Bed.....	1	.....	12,250
Gray.....	Garrison's, Hudson river, New York.....	2	Edge.....	1	.....	18,370
Do.....	Peterhead, Scotland*	1.5	.....	.....	8,290 to 13,636	.....
Do.....	do*	1	.....	.....	.....	6,273
Do.....	do*	.....	.....	.....	9,666 to 10,192	.....

* Foreign stones for comparison.

STATISTICS CONCERNING THE PHYSICAL PROPERTIES OF THE BUILDING STONES USED IN NEW YORK CITY.

GRANITE.

Specific gravity.	Weight of one cubic foot.	Ratio of absorption.	Remarks.	Transverse strain.	Authority.
	<i>Pounds.</i>			<i>Pounds.</i>	
2.600	162.5	Not noticeable.....	Boldly marked, resembling fine breccia.....		Q. A. Gillmore.
{		do.....	do.....	{	Do.
		do.....	Used in Central park.....		Do.
2.631 to 2.600	164.1 to 166.3	Very slow.....	Burst suddenly.....		Do.
2.600	166.3	do.....	do.....		Do.
2.635	166.5	Very slow.....	Burst suddenly.....		C. B. Richards.
2.750	171.9	Very slow.....	Burst suddenly.....		Q. A. Gillmore.
{	2.670	166.9	Burst suddenly.....		Probasco.
					Q. A. Gillmore.
2.650	165.6	Not noticeable.....	Boldly marked, resembling fine breccia.....		C. B. Richards.
	166.5	0.233 per cent.....			Q. A. Gillmore.
2.630	164.4	Not noticeable.....	Finely marked; bluish.....		J. S. Newberry.
{					Probasco.
					Q. A. Gillmore.
					Probasco.
					Do.
					Probasco.
					C. B. Richards.
2.660	166.2	Very slow.....	Cracked before bursting.....		Probasco.
2.07				235	Q. A. Gillmore.
2.695	168.7	Very slow.....	Cracked before bursting.....		Probasco.
2.649 to 2.657	165.8	3.25 grains.....			T. Rodman.
		do.....	Broke suddenly.....		C. B. Richards.
{					Q. A. Gillmore.
					W. R. Johnson.
2.610	168.2	1 to 152.....			Do.
2.65				274	Do.
2.640	165.6	Very slow.....	Broke suddenly.....		Q. A. Gillmore.
{	2.670	166.9	do.....		Do.
					C. B. Richards.
2.706	168.7	Very slow.....	Broke suddenly.....		Q. A. Gillmore.
2.835	177.2	Very slow.....	Broke suddenly.....		Probasco.
{	2.660	166.25	Broke suddenly.....		Q. A. Gillmore.
					Q. A. Gillmore.
2.630	164.4	do.....	do.....		Do.
{	2.645	165.4	1 to 201.....		Do.
					Do.
2.655	162.2	Very slow.....	Cracked before bursting.....		Do.
2.690	168.1	do.....	Broke suddenly.....		Do.
{	2.580	161.3	1 to 167.....		Do.
					G. Rennie.
		0.5 to 3.0 per cent.....	Wray.....		V.
					Bramah.

BUILDING STONES AND THE QUARRY INDUSTRY.

STATISTICS CONCERNING THE PHYSICAL PROPERTIES OF THE BUILDING STONES USED IN NEW YORK CITY—Continued.

GNEISS.

Kind.	Locality.	Size of cube in inches.	Position.	Number of trials.	COMPRESSIVE STRENGTH PER SQUARE INCH.	
					Range.	Average.
Harlem stone.....	Morrisania, New York.....	2		1	<i>Pounds.</i>	<i>Pounds.</i>
Dark.....	Madison avenue, New York.....	2	Bed.....	1		15,800
		2	Edge.....	1		11,250
						12,500

TRAP.

Blue.....	Staten island, New York.....	2	Bed.....	1		22,250
Very dark.....	Jersey City heights, New Jersey.....	2	Bed.....	2	20,750 to 22,250	
Do.....	Palisades, New Jersey.....					19,700
Whetstone.....	England*.....					8,267
Do.....	do*.....					11,970

MARBLE.

Eastchester.....	Tuckahoe, New York.....	2	Bed.....	2	12,050 to 12,950	12,500
Do.....	do.....	2	Bed.....	2	13,594 to 13,711	13,652
Do.....		4		1		4,081
Do.....		1.5	Bed.....	1		23,017
Do.....	Hastings, New York.....	1.5	Bed.....	9		18,941
Do.....	Pleasantville, New York.....				18,000 to 24,600	
Vermont.....	Dorset, Vermont.....	2	Bed.....	1		7,612
Do.....	do.....	2	Edge.....	1		8,670
Do.....	Rutland, Vermont.....				1,305 to 1,375	
Do.....	West Rutland, Vermont.....				11,000 to 12,500	
Do.....	Pittsford, Vermont.....				11,250 to 18,750	
Do.....	Sutherland Falls, Vermont.....				10,243 to 11,250	
Do.....	do.....				12,250 to 20,000	
Do.....	West Stockbridge, Massachusetts.....	1.5	Bed.....	4		10,382
Do.....	do.....	1.5	Bed.....	12		9,071
Do.....	Stockbridge, Massachusetts.....	1.5	Bed.....	10		8,812
Do.....	Lenox, Massachusetts.....	1.5	Bed.....	8		7,153
Do.....	Stockbridge, Massachusetts.....	4		1		2,410
Do.....	Lee, Massachusetts.....	1.5	Bed.....	3		22,702
White.....	do.....				12,017 to 13,972	
Bluish.....	do.....				7,705 to 17,054	
Do.....	Canaan, Connecticut.....				4,958 to 8,794	
Carrara.....	Carrara, Italy*.....				9,723 to 13,600	
Common Italian.....	Italy*.....	2	Bed.....	2	12,250 to 13,002	12,156
White Italian.....	do*.....	1.5				21,778

SANDSTONE.

Freestone.....	Dorchester, New Brunswick.....	2	Bed.....	2	9,150 to 9,412	9,281
Freestone (olive).....	do.....	2	Bed.....	1		4,250
		2	Edge.....	1		6,050
Freestone (brown).....	Mary's Point, New Brunswick.....					9,250
Freestone (olive).....	do.....					9,250
Freestone (dark brown).....	do.....				7,586 to 7,828	
Freestone.....	Wood Point, New Brunswick.....				3,970 to 4,932	
Do.....	Nova Scotia.....				6,532 to 10,322	
Brownstone.....	Middletown, Connecticut.....	2	Bed.....	1		6,950
Do.....	Portland, Connecticut.....	2	Edge.....	1		5,550
Do.....	San Diego, California*.....				5,806 to 10,928	
Carlisle stone.....	Corsehill, Scotland*.....	6				20,039
Do.....	Craigleith, Scotland*.....	1				7,909
Do.....	do*.....	1.5				2,187
Do.....	do*.....	2				5,489
Do.....	do*.....	2				7,842
Brown.....	Little Falls, New York.....	2	Bed.....	1		9,850
		2	Edge.....	1		9,150
Red.....	Haverstraw, New York.....	2	Bed.....	1		4,350
		2	Edge.....	1		4,025

* Foreign rocks for comparison.

STONE CONSTRUCTION IN CITIES.

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STATISTICS CONCERNING THE PHYSICAL PROPERTIES OF THE BUILDING STONES USED IN NEW YORK CITY—Continued.

GNEISS.

Specific gravity.	Weight of one cubic foot.	Ratio of absorption.	Remarks.	Transverse strain.	Authority.
	<i>Pounds.</i>			<i>Pounds.</i>	
2.720	170.0	Very slight.....	Broke suddenly.....		Q. A. Gillmore.
2.920	182.5		Probably rich in iron.....		

TRAP.

2.861	178.8	Very slight.....	Cracked before bursting.....		
3.030	180.5	Not noticeable.....			
			For pavements.....		
			Basalt (?).....		Bramah.
		Trace.....	do.....		Fairbairn.

MARBLE.

2.875	170.7	Very small.....	Burst without cracking.....		Q. A. Gillmore.
2.800	175.0		Burst without cracking; whiter and better variety.....		Do.
					Page.
2.858	178.6	0.00393 oz.....			United States Commission, 1851.
2.861	178.8	0.0066 oz.....			Do.
					Q. A. Gillmore.
2.635	164.7	1 to 170.....	With slight explosion.....		Do.
2.683	167.8		do.....		Do.
2.635					H. A. Cutting.
2.666	167.0				United States Government.
2.661 to 2.672					H. A. Cutting.
					F. E. Kidder.
	166-178				United States Government.
2.714	169.6	0.0068 oz.....			United States Commission, 1851.
2.713	169.6	0.007025 oz.....			Do.
2.713	169.6	0.0087 oz.....			Do.
2.709	169.3	0.011063 oz.....			Do.
					Page.
2.802	178.9	0.0103 oz.....			United States Commission, 1851.
					Do.
					C. B. Richards.
					Do.
2.69	168.2	Very small.....	Without cracking.....		Q. A. Gillmore.
		Trace.....			Rennie.

SANDSTONE.

			Without cracking.....		Q. A. Gillmore.
			do.....		Do.
			do.....		Do.
					J. Henry.
					Do.
					C. B. Richards.
2.860	148.5	1-40.....	Without cracking.....		Q. A. Gillmore.
2.640				425	C. B. Richards.
					T. Rodman.
					Kirkaldy.
					V.
					G. Rennie.
		8 per cent.....			Royal Commission.
2.250	140.6	1 to 84.....	Suddenly hardened by weathering.....		Q. A. Gillmore.
2.130	133.1	1 to 23.....	Without cracking.....		Do

STATISTICS CONCERNING THE PHYSICAL PROPERTIES OF THE BUILDING STONES USED IN NEW YORK CITY—Continued.

SANDSTONE—Continued.

Kind.	Locality.	Size of cube in inches.	Position.	Number of trials.	COMPRESSIVE STRENGTH PER SQUARE INCH.	
					Range.	Average.
					<i>Pounds.</i>	<i>Pounds.</i>
Gray.....	Belleville, New Jersey.....	2	Bed.....	1	.....	11,700
		2	Edge.....	1	.....	10,250
Pink.....	Medina, New York.....	2	Bed.....	1	.....	17,250
		2	Edge.....	1	.....	14,812
Drab.....	do.....	2	Bed.....	1	.....	17,725
Do.....	do.....	2	Edge.....	1	.....	11,880
Do.....	Berea, Ohio.....	2	Bed.....	5	29,000 to 41,000	.....
Brownish-gray.....	North Amherst, Ohio.....	2	Bed.....	2	5,775 to 6,650	6,212
		2	Edge.....	1		5,450
Light drab.....	do.....				7,000 to 8,000	.....
Do.....	Cleveland, Ohio.....				6,141 to 8,955	.....
Do.....	Berlin, Ohio.....	2	Bed.....		.....	14,250
		2	Edge.....		.....	12,000
Reddish brown.....	East Longmeadow, Massachusetts.....				9,121 to 13,500	.....
Brown.....	do.....				8,062 to 8,812	.....
Do.....	do.....				13,520 to 14,650	.....

SANDSTONE (BLUE-STONE).

Blue-stone.....	Hudson river, New York.....	2	Bed.....		9,000 to 13,000	.....
		2	Edge.....		.....	11,482
Do.....	Ulster county, New York.....				21,150 to 23,825	.....
Graywacke.....	Penmaenmawr, Wales*	2			.....	10,893

LIMESTONE.

Glens Falls.....	Glens Falls, New York.....	2	Bed.....	1	.....	11,475
		2	Edge.....	1	.....	10,750
Lake.....	Lake Champlain.....	2	Bed.....	1	.....	25,000
		2	Edge.....	1	.....	21,500
North river.....	Kingston, New York.....	2	Bed.....	1	.....	13,900
		2	Edge.....	1	.....	11,050
Do.....	do.....	2	Bed.....		13,750 to 15,550	.....
Do.....	Garrison's station, New York.....	2	Bed.....	10	.....	18,500
		2	Edge.....	1	.....	18,275
Do.....	do.....	2	Bed.....	8	17,750 to 18,775	18,262
Caen.....	Caen, France*	2	Bed.....	2	3,450 to 3,650	3,550

*Foreign rocks for comparison.

STATISTICS CONCERNING THE PHYSICAL PROPERTIES OF THE BUILDING STONES USED IN NEW YORK CITY—Continued.

SANDSTONE—Continued.

Specific gravity.	Weight of one cubic foot.	Ratio of absorption.	Remarks.	Transverse strain.	Authority.
	<i>Pounds.</i>			<i>Pounds.</i>	
} 2.259	141.0	1 to 27.....	Suddenly.....		Q. A. Gillmore.
2.410	150.6	1 to 55.....	Lilac.....		Do.
2.390	149.3	1 to 51.....	More purple.....		Do.
2.420	151.1	1 to 70.....			Do.
2.110 to 2.200	131.9 to 137.5	1.16 to 1.24.....	Without cracking; very friable.....		Probasco.
2.16 to 2.19	135.0 to 136.9	1 to 19.....	do.....		Q. A. Gillmore.
2.14	133.7		do.....		Do.
					J. S. Newberry.
					C. B. Richards.
					Q. A. Gillmore.
					Do.
					Saulsbury.
					McGregory.

SANDSTONE (BLUE-STONE).

					Probasco.
					Do.
2.720				609	T. Rodman.
					Fairbairn.

LIMESTONE.

} 2.700	168.8		Burst without cracking.....		Q. A. Gillmore.
} 2.750	171.9		do.....		Do.
} 2.69	168.2		do.....		Do.
					Probasco.
} 2.635	164.7		Burst without cracking.....		Q. A. Gillmore.
2.616	163.5		do.....		Do.
1.900	118.8	{ 1 to 19..... 9.86..... }	Burst without cracking; tensile strength, 150 (G. R. Bunnell); loss in dilute acid and boiling water, 6.17 per cent.	{.....}	Do.

NORTH ADAMS, MASSACHUSETTS.

The materials used in the principal stone structures of this city are limestone from North Adams and quartzite from Clarksburg, Massachusetts. The foundations and underpinnings are of local limestone and Clarksburg quartzite, with some blue-stone. The Catholic church and two factories are built of limestone from the local quarries. Dr. Babbitts' residence and Mr. Pendeman's office are two small edifices built of quartzite; as this contains a little pyrites some of the blocks are stained. The new Episcopal church in course of construction will be of blue-stone and pressed brick, with Longmeadow and Ohio sandstone trimmings over the windows and doors. The steps to the chancel will be of marble and the interior trimmings over the windows of terra-cotta. The railroad depot buildings and most of the churches are built of brick. The Hoosac tunnel is at this place, but the material used for archways is brick. The streets are paved with stone, the chief part of such pavement being on Eagle street, where cobble-stones are used for the purpose. The sidewalk on one block in front of the Wilson house is paved with North River blue-stone. Many of the sidewalks are paved with concrete; the curbs are of blue-stone, limestone, and quartzite.

NORTHAMPTON, MASSACHUSETTS.

There are but two buildings in Northampton entirely constructed of stone, and there are two others with stone fronts. The material used for the better class of stone construction is sandstone from Longmeadow, Massachusetts, and brownstone from Portland, Connecticut. One of the Congregational churches is built of the former material and the Smith Charities building of the latter. The materials used for foundations and underpinnings are sandstone and granite from quarries within the limits of the town, as both these formations are here exposed. One or two hundred feet of the pavement in front of the court-house is of thinly bedded sandstone from Smith's ferry; these blocks frequently exhibit rows of "bird tracks" upon them. They are now very much worn and the tracks are becoming obliterated. There is a quarry of coarse sandstone very near the Mount Tom station, 3 miles south of the main village, which furnishes stone for ordinary purposes of construction in the neighborhood. The streets are not paved with stone, with the exception of the space fronting the court-house already mentioned, and the sidewalk pavement is mostly of asphalt and brick; curbstones are of granite. The piers of the bridge across the Connecticut river are of sandstone from neighboring quarries.

OGDENSBURG, NEW YORK.

Limestone from the quarries near this city is of good quality, blue-black in color; and there are some examples of excellent stone work built of it, including range work and ashlar. Some of the structures of this limestone have Potsdam sandstone trimmings. These two materials when used together make a good harmony of colors, and the effect is pleasing. In some portions of these quarries it is necessary to use care in selecting the material, as parts of it contain iron. Some of the Ohio sandstones in the structures here have discolored, while others have retained their original appearance. There are several stone grist-mills in the city, two of the number being trimmed with sandstone from Potsdam and Hammond, Saint Lawrence county; the others are trimmed with native limestone. There are some heavy bridge abutments all constructed of limestone from the quarries within the city limits, and the breakwater is constructed of the same material. The streets and roadways are macadamized with limestone from the local quarries, and a few are paved with Potsdam sandstone; but few of the sidewalks are paved with stone, and the material used is the Potsdam sandstone. The curbstones are of Potsdam stone and limestone from Chaumont.

ORANGE, NEW JERSEY.

The cities of South and East Orange may be said to be noted for the size and elegance of their church edifices. They are all substantial buildings; several of them are brick with sandstone trimmings. Sandstone is largely used in cemetery walls, in walls surrounding lawns and other inclosures, in steps, house-trimmings, and in cellars and foundations. Nearly all of it has been obtained from the quarries in the faces of First mountain, 2 miles west of the town of Orange. The durability of the stone has been tested in the First Presbyterian church, erected in 1813, and also in some of the old walls in farm-houses of the surrounding country. The town is also noted for its Telford or macadamized roadways, in common with all of Essex county. Many miles of the best roads found in the United States are in this county; they are made of trap-rock from the large quarries in the eastern face of Orange or First mountain, a few miles west of Orange, which are all under the management of the Essex Road board. (a)

The following is a list of prominent stone structures in Orange, with materials from which they were constructed: Saint Mark's P. E. church, Grace P. E. church, First Presbyterian church, Central Presbyterian church, Munn Avenue church, South Orange Presbyterian church, all of Orange sandstone; South Orange P. E. church, trap-

a See Annual Report of the State Geologist of New Jersey, 1871.

rock with sandstone trimmings, both from local quarries; Orange Valley Congregational church, trap-rock with sandstone trimmings; South Orange Baptist church, Ohio sandstone; Saint Mark's P. E. church and school, Mr. J. G. Barker's residence, Mr. Davis Collamore's house, and Mr. Tome's private residence, all of trap-rock and sandstone, from local quarries.

There is no stone street pavement, excepting the road-bed of the First Street horse-car road, a road which is paved partly with rectangular blocks of trap-rock and partly with cobble-stones. The streets and roadways are pretty generally macadamized with trap-rock. The sidewalks are largely paved with stone, and the material used for this purpose is the North River blue-stone, from Ulster county, New York. Curbs are of the same material.

OSWEGO, NEW YORK.

The Oswego gray sandstone quarried in the vicinity is a good building material, except when set on edge in the exterior walls of buildings, in which case it flakes off by the action of dampness and frost. It is not suitable for sidewalk paving because its laminated structure causes it to separate into thin layers, when it easily breaks up under the action of foot-wear. Limestone from Chaumont, Jefferson county, New York, was used in the piers and abutments of the highway and railway bridges crossing the Oswego river in this city; it was also the principal stone used in the two dams across this river. A portion of the old breakwater now being destroyed consists of cut limestone from Chaumont. Fort Ontario—principally an earthwork—has some stone bastions of Oswego gray sandstone, and the largest and best quarry in this city is located in the fort grounds. The stone filling in the new breakwater cribs consists mostly of hardhead cobbles, with some quarried gray sandstone. Some red sandstone, found along the Oswego river about a mile south of its mouth, was used for crib-filling, but, owing to its rapid disintegration by wave action, it is no longer used for that purpose. For foundations and underpinnings the Oswego gray sandstone quarried in the immediate vicinity and some Chaumont limestone were used. There are but three streets paved with stone, and those chiefly with cobble. About half a mile of the 2 miles of paved street consists of block stone of materials from Potsdam, Jefferson county, North River blue-stone from Ulster county, and Oswego sandstone. The sidewalks are but little paved with stone, and the material used is Cayuga Lake stone, with some also from Chenango and Delaware counties. The curbstones are of Chenango County sandstone and Chaumont limestone.

PATERSON, NEW JERSEY.

There are sandstone quarries in the First mountain, near Paterson, which furnish a large part of the material for stone construction in the city. This sandstone is used largely in cellar walls and foundations; the quarries are in the eastern face of the mountain within the city limits and above the general level of the city, so that stone is afforded at a low rate. A quarry at Haledon, about 3 miles to the northwest, has furnished some material during the past season; this is a buff-colored Triassic sandstone resembling the Ohio sandstone. Within the city limits there are several old farm-houses, or structures originally built for farmers' houses, of red sandstone; the durability of the material as shown in these buildings is evidence of the value and adaptation to use in stone construction. Some of them were probably built of surface rock, that is, of loose blocks found on the surface in clearing up the country for farming purposes. In the adjacent parts of Passaic county there are very many old houses built of the native sandstone. These houses are usually low, being only a story and a half in height. The stone in the walls is sometimes dressed with square edges, and in some instances it is laid up rough-dressed only; and much of it is coarse-grained and soft.

The brown freestone of the Paterson and Little Falls quarries has been used extensively in the city, and there are many large structures of the material, among which may be mentioned the Passaic County court-house and jail, and the Roman Catholic church. This material has also been used in the construction of the aqueduct of the Water-Power Company, in the bridges over the canal, and in abutments and piers of bridges crossing the Passaic river; also largely in walls inclosing lawns and private grounds. The number of miles of graded streets in Paterson is 53½; of this length 2.76 miles are paved with cobble-stones; 0.16 mile with macadamized block pavement, the material being brought from New England; 9.44 miles with macadamized Telford pavement; the total number of miles of paved streets, 12.36. The sidewalks are largely paved with stone, there being about 25 miles of stone sidewalks, and the material used for this purpose is the North River blue-stone, with some stone from Carr's, Sussex county. The curbs are of North River blue-stone.

PAWTUCKET, RHODE ISLAND.

The five stone buildings in Pawtucket are constructed of what is known as the ledge stone, which is quarried in the vicinity. Foundations and underpinnings are of blue and red slate from ledges in the town, and boulders gathered in the vicinity. Some of the underpinnings are of granite from Smithfield and Diamond Hill. All the mills, excepting two or three, are of brick or wood. There is one large mill made of ledge stone and boulders in the vicinity. There are ledges of slate from which material is obtained for walls, underpinnings, etc., and

bowlders are somewhat used for the same purposes. The two materials most used beside brick, for post trimmings and sills and underpinnings in the better houses, are granites from Smithfield and from Diamond Hill. The post-office front is partially of yellow sandstone, and the remainder is of brick with red sandstone trimmings, and several polished columns of red Aberdeen granite which resembles very much the material from Jonesboro', Maine. There are two stone bridges in the city; the upper one, built in 1858, has two arches of granite from a quarry in North Providence, near Smithfield. The Division Street bridge is a fine granite structure of 9 arches, and is built of granite quarried at Sterling, Connecticut. Only the streets in the central portion of the town are paved, and those chiefly with cobble-stones, though in recent years granite blocks of material from Diamond Hill have been employed. The sidewalk paving is chiefly of brick and concrete, though Hudson River flags and granite have been employed to a limited extent for this purpose. The curbstones are of granite from Diamond Hill and Smithfield, with some Hudson River blue-stone.

PETERSBURG, VIRGINIA.

There are three stone buildings in Petersburg—one, the custom-house, built of granite from the Namozine district, Dinwiddie county, in the immediate vicinity of the city. It is now more than twenty years since it was completed, and the stone is remarkably free from discoloration of every kind. That in the foundation, from the quarry of Dr. E. W. Lassiter, ranks with the best of building stones; and that in the superstructure is from a quarry now abandoned. The two fronts of Connecticut sandstone, on Sycamore street, show signs of decay; the material is destructible even in this latitude. The materials for foundations and all other ordinary purposes are obtained from the granite quarries in the immediate vicinity. A few of the streets are paved with cobble-stone; there is very little sidewalk paving of granite from the local quarries, and North River blue-stone, from Roudout, New York, has also been used for paving. Curbstones are of local granite.

PHILADELPHIA, PENNSYLVANIA.

That stone began to be an important element in construction in Philadelphia from its first settlement, and that it has always been preferred to other materials for use in the better class of buildings, we learn from old records that occasionally refer to the subject, and from the evidence of stone structures of various dates still standing. Many of the first brick houses with stone foundations are still standing in the older parts of the city, and may be known by their quaint style of architecture and by the peculiar checkered appearance of their walls, which are built of red and glazed bricks, arranged alternately—as the Penn mansion in Letitia court, built in 1682; the Swedes' church, in 1698, and Carpenter's hall, in 1770.

Government buildings, and college, school, church, hospital, prison, and most other public buildings are of stone, which has always held the first rank in the construction of the private residences of the wealthier classes. Stone is also used to a more than ordinary extent for caps, sills, base courses, corners, and other trimmings of brick buildings. One of the most noticeable features of the city, and one which adds much to its appearance of uniformity, is due to the custom which has long reigned here of trimming brick buildings with plain marble caps and sills. Of late years, however, the custom has not been so rigid, as Connecticut brownstone, Amherst (Ohio) stone, Hummelstown (Pennsylvania) brownstone, and North River blue-stone have been extensively used for trimmings.

A record in the office of revision of taxes in Philadelphia gives the following statistics: Total number of buildings in city in 1880, 168,176; number of stone buildings in city in 1880, 10,518; percentage of stone buildings, 6.

Of the 10,518 buildings classed as stone it is estimated that about 6,000 are constructed entirely of stone, and that the remaining 4,518 have stone fronts.

Until within the last fifty years the rock formations in and near the city had furnished very nearly all the stone used for building purposes; within that time Connecticut brownstone, North River blue-stone, New England granite, Vermont and Massachusetts marbles, Ohio sandstone, Chester county, Pennsylvania, serpentine or greenstone, Hummelstown brownstone, Richmond granite, and other stones have been introduced and extensively used for the better class of buildings.

The southern portion of Philadelphia is built on an alluvial deposit of gravel and clay which furnishes nothing for building purposes except the smooth, rounded pebbles gathered on the banks of the Delaware, and which have been extensively applied to street paving—two-thirds, perhaps, of the pavements in the city being of this material.

Near the central part of the city, the southern gneissic district, described by Professor Henry D. Rogers, (a) sets in. Of the area (129 square miles), including within the present limits of the city all not included in the alluvial deposit before described, excepting a few isolated exposures of steatite and serpentine, is made of this gneissic formation, and the ground where it prevails is gently rolling and sometimes hilly in its features. The process of grading and leveling has been going on to such an extent, especially in the more thickly settled parts of the city, that much of this rolling ground has been much modified in appearance. West Philadelphia, Fairmount park, Germantown, Manayunk, and other suburbs still retain something of their original features of surface.

Near the Fairmount water-works cliffs of the gneiss are exposed to view, the large reservoir being in fact built on a natural elevation of this stone, and most of the masonry in connection with the water-works is of the same material.

Professor Rogers, in the report before mentioned, describes the gneiss substantially as follows: There are three principal varieties. The most common and typical variety is a gray-bluish rather finely laminated triple mixture of quartz, feldspar, and mica, the quartz for the most part white or transparent, the feldspar usually white and very generally somewhat chalky from incipient decomposition, and the mica black or dark brown and in small plates. The next most common variety is a dark bluish-gray, sometimes grayish-black, gneiss composed of hornblende and quartz with sometimes a little feldspar, the hornblende greatly predominating. A third variety is a micaceous quartzose rock generally of a light gray color. Some beds of this variety contain such a predominance of the crystalline quartz in minute granular division, and such a subordinate quantity of mica disseminated through it, as to give it the character of ordinary gray whetstone.

These three varieties of gneiss, thus described by Professor Rogers, are found in inexhaustible quantities within and near the limits of the city, and have been its principal resource for the ruder and plainer purposes of construction. It has been freely used in foundations, cellars, inclosure and terrace walls, bridge abutments, piers, wharves, rubble pavements, and work of that class, as well as in the construction of private residences and church, school, and other public buildings. Foundation and cellar work was all of this material until within the past fifteen years. Conshohocken limestone has been extensively used for the same purpose; an exception should perhaps be made also in favor of the Trenton brownstone, which has of late years been used to a limited extent for foundations.

Walls of this Schuylkill gneiss, as it is sometimes called, surround the Girard College grounds, the Eastern penitentiary, Laurel Hill, Woodlands, and numerous other cemeteries and public inclosures. Private residences were built of it in vicinities where it could be conveniently quarried, and in the early history of the city it was about the only source of supply for all purposes of stone construction, as may be seen by an examination of such of the structures of the last century and of the early part of the seventeenth century as are yet standing.

The following are among the buildings having foundations of the Schuylkill gneiss. The house in Letitia court, built by order of William Penn, about 1682, the oldest house in Pennsylvania, and said to be the first built within the limits of the city; Old Swedes' church, built in 1698, by settlers from Sweden, and presided over for one hundred and thirty years by pastors sent by the court of Stockholm; Carpenter's hall, built in 1770, and in which the first Continental Congress assembled in 1774; Independence hall, where the Declaration of Independence was signed July 4, 1776; Christ church on Second street, built in 1727, and numerous old-fashioned and now dilapidated brick buildings on Second street and vicinity, which was in ante-Revolutionary days the business and fashionable part of the city.

Although in this locality brick seems to have been the favorite material for superstructures of the more pretentious buildings in early times, in the more northern portions, where the gneiss was at hand in inexhaustible quantities houses were built entirely of this material. Such parts of the original walls of the Belmont mansion, built in 1742 in Fairmount park, as are yet standing, are of the Schuylkill gneiss. The Mount Pleasant mansion, so rich in historic associations, situated on the opposite side of the Schuylkill from Belmont, is built of rectangular blocks of the gneiss. It is the variety which contains considerable feldspar in its composition, and the surface of the stone where exposed to the atmosphere seems inclined to roughen and crumble because of the decomposition of that ingredient. The walls are covered with a heavy coat of paint, which proves to be quite a valuable protection against the decomposing influence of the atmosphere. This house was built about the middle of the last century by Captain John McPherson, and it was purchased and occupied by Benedict Arnold while he was military governor of Philadelphia during the Revolution.

The house of John Penn, built in 1785, and still to be seen in the Zoological Gardens, is of this material, and is also protected by a coat of paint. The effectiveness of paint in protecting the variety of this gneiss, which contains considerable of the vulnerable feldspar in its composition, may also be seen in the portions of the foundations of Christ church which are above ground. In places where it has been abraded the roughening and crumbling process is going on, while the parts covered by paint remain intact.

In Germantown, now a suburb of Philadelphia, the Dutch settlers from the first constructed their houses of the gneiss which underlies the locality. Colonel Timothy Pickering, who was present at the battle of Germantown, writes that most of the houses standing there at that time were of stone. Chief Justice Benjamin Chew's stone house, Clivedon, which is at present occupied by his descendants, and is in a good state of preservation, was assaulted by the light artillery of the Americans during the battle for the purpose of dislodging several companies of British who had taken refuge there, but the masonry proved so solid that no impression was made except to break the windows and doors and destroy the statuary in the inclosed grounds.

The Woodlands, once a private residence occupied by the Hamilton family, built of rough blocks of the Schuylkill gneiss about the time of the Revolution, still stands in Woodlands cemetery. The high massive walls and imposing front of the Eastern penitentiary are built of the same material; also a number of churches in the central and northern portions of the city. This material is generally very distinctly stratified, the plates of mica showing quite plainly the parallel arrangement; but in the older buildings where the stone was used, it was laid

up by the masons indiscriminately, apparently to suit their convenience, much of it being set on edge. This is particularly noticeable in the foundation walls of the Old Swedes' church. The stone seems to bear this treatment of setting on edge unusually well, showing but little disposition to scale off, and the practice still continues to some extent, as was noticed in buildings of recent date, particularly in the case of the buildings of the university of Pennsylvania, the foundations and basement stories of which are built of the gneiss. The treatment of setting on edge detracts something from the solidity and durability of a wall. Stratified rocks where used as building stone should invariably be laid the bed way.

An examination of many pretentious buildings of stone in this city shows that this important principle even now is often disregarded, sometimes in the case of stones least capable of withstanding such treatment. In one instance a huge rectangular block of brownstone serving as the base of a fine Corinthian column 6 feet in diameter was observed to be set on edge and already much defaced by the spalling off of the stone in thick slices. If the same block had been set the bed way, which it would seem could have been done quite as conveniently, no such injurious consequences would have resulted. Many of the stones used here for building purposes when set on edge will stand considerably less compression than where set bed way, as is demonstrated by crushing tests.

PENNSYLVANIA MARBLE.—The next source from which Philadelphia early began to draw building material was the marble in the limestone basin of Montgomery county. This is a narrow isolated strip of what is called by Rogers the Auroral limestone, the Siluro-Cambrian limestone of Professor Lesley in the *Reports of the Second Geological Survey of Pennsylvania*, and which is so important a feature farther to the northward in the Kittatinny or Cumberland valley. This material appears to have been first quarried by Daniel Hitner, about the time of the Revolution, or shortly afterward, (a) and from its close proximity to the city and its superiority in point of beauty to the Schuylkill gneiss, which had been the principal source of supply to builders up to this time, its use steadily increased from the first. Until 1825 it was transported to the city by teams, but about this time the completion of the Schuylkill canal afforded superior means of transportation and gave a great impulse to the use of this marble for building purposes in Philadelphia. In many parts of the city at the present time block after block may be seen having window caps and sills, and in many cases base courses and steps of this material. Of late years, however, New England marble is also largely used for these purposes.

The Montgomery County marble is distinguished from the other marbles in use here by its bluish color and coarser texture, the peculiarities of appearance being such as to make it easily recognizable after being once observed. It continued to be the only material used in the better class of stone construction from the time of its introduction to about 1840, when a new era was entered upon by the gradual introduction of brownstone, granites, and marbles from more distant points. During its reign of popularity many fine public buildings were constructed of it, among which are the Girard bank, built in 1798, the custom-house in 1819, United States mint in 1829, naval asylum in 1830, Merchants' exchange in 1832, and Girard college, begun in 1833. The sarcophagi in which rest the bodies of George and Martha Washington, at Mount Vernon, were wrought of this marble. A sarcophagus for Henry Clay, of Kentucky, is also said to have been made of it. Its reputation for durability is of the highest, but the superiority in point of beauty of the marbles from Vermont and Massachusetts and the Italian marble excludes it from the highest class of architecture, though it is now extensively used in that large class of stone-work wherein beauty is a secondary consideration, as for coping, inclosures, bases of monuments, and all the less ornamental class of work in cemeteries. Monuments are also frequently made of it, and in point of durability they often prove equal or superior to those made of the finer marbles.

Of the buildings constructed of Pennsylvania marble, the main Girard College building is by far the most considerable. This structure, well known as one of the finest specimens of Corinthian architecture in the world, is of Montgomery County marble, except the columns, bases of columns and architraves, which are of marble from Egremont, Massachusetts. There is much connected with this building calculated to offer a profitable subject for study to all who are interested in stone construction. The wide portico, extending entirely around the building, and supported by massive fluted columns, protects the outer walls entirely from wet, thus leaving scarcely any part of the building exposed to the destructive elements, excepting the marble roof and the outer steps, parts readily replaced when they have yielded to the effects of time. No combustible material enters into its construction nor into that of any of the accessory buildings designed for the accommodation of its pupils, and the ample grounds with which it is surrounded secure it from any injurious effects that might arise from the burning of adjacent buildings.

Since the transportation facilities by rail and water have enabled builders to choose their materials from a wide list, fashion seems to have dominated here to such an extent, as to private residences especially, that particular building stones have had their periods of popularity, some longer, and some shorter, when they were used for the better class of work to the partial exclusion of other stones.

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The following list of some of the most important buildings, with the dates or approximate dates of construction, will give a general idea of the time of introduction as well as of the periods of greatest popularity of each of the principal building stones that have been in use here from the first settlement of the city up to the present time:

Material.	Name of building.	Date of construction.
Schuylkill gneiss.....	Penn (Lotitia) mansion (foundation).....	1682
	Old Swedes' church (foundation).....	1698
	Christ church (foundation).....	1727
	Old state-house (foundation).....	1732
	Belmont mansion.....	1742
	Mount Pleasant mansion.....	1760
	Church, Saint James of Kingsessing.....	1762
	Mennonite church.....	1770
	Chew house, or Clivedon.....	1770
	Carpenter's hall (foundation).....	1770
	Woodlands mansion.....	1775
	Solitude.....	1785
	Eastern penitentiary.....	1823
	Seminary of Saint Vincent de Paul.....	1876
Pennsylvania (Montgomery county) marble...	Girard bank.....	1798
	United States custom-house.....	1819
	United States mint.....	1829
	United States naval asylum.....	1830
	Merchant's exchange.....	1832
Granite from—	Girard college.....	1833
Quincy, Massachusetts.....	Moyamensing prison.....	1835
Cape Ann, Massachusetts.....	Woodlands Cemetery gateway.....	1850
Quincy, Massachusetts.....	Swain's building, Chestnut street.....	1850-'60
	Elliot's building, Chestnut street.....	1850-'60
	Leland's building, Chestnut street.....	1850-'60
	Jayne's building, Chestnut street.....	1850-'60
	Dunbar's building, Chestnut street.....	1850-'60
	Mellor & Williamson's building, Chestnut street.....	1850-'60
	Jayne's building, Third street.....	1850-'60
	Leland's building, Third street.....	1850-'60
	Cope & Co.'s building, Market street.....	1850-'60
	Thurloew Hughes & Co., Fifth street.....	1850-'60
	Commercial bank.....	1850-'60
	Philadelphia National bank.....	1850-'60
	American Sunday-School Union.....	1850-'60
	First National bank.....	1865
Cape Ann, Massachusetts.....	Provident Life and Trust building.....	1865
Quincy, Massachusetts.....	Manufacturers' bank.....	1868
	French, Richards & Co.'s building.....	1869
	Pennsylvania Life and Trust Company building.....	1870
	Pennsylvania Railroad offices.....	1870
Cape Ann and Fox island, Maine.....	New Masonic temple (the porch is of Quincy granite).....	1872
Concord, New Hampshire.....	Presbyterian Board of Publication.....	1873
Westerly, Rhode Island.....	New York Mutual Life Insurance building.....	1875
Concord and Richmond.....	Memorial hall.....	1876
Cape Ann and Quincy.....	Ridgeway library.....	1876
Dix island and Richmond.....	New post-office.....	Unfinished.
Connecticut brownstone.....	Moyamensing prison (east front).....	1835
	SS. Peter and Paul's Catholic cathedral (front).....	1846
	Saint Mark's P. E. church.....	1849
	Bank of Commerce.....	1850
	Bank of North America.....	1850
	Girard hotel.....	1850
	Old Masonic temple.....	1853
	Academy of Music (trimmings).....	1855
	Holy Trinity Episcopal church.....	1857
	First Baptist church.....	1857
	Saint Clement's P. E. church.....	1859
	Fifth Baptist church.....	1863
	Union League house (trimmings).....	1864
	Harrison private residence.....	1851
Pietou sandstone from Nova Scotia and New Brunswick.	Sharpless Brothers' block.....	1858
	Strawbridge & Clothier block.....	1860
	Continental hotel.....	1860

Material.	Name of building.	Date of construction.
Marble from—		
Lee, Massachusetts.....	Farmers' and Mechanics' bank.....	1854
Vermont.....	Harrah private residence.....	1855
	Third National bank.....	1863
	Homer & Collady block.....	1866
Lee, Massachusetts.....	Dr. Jayne's private residence.....	1867
Vermont.....	Haffleigh's building.....	1868
	White's building, corner Twelfth and Chestnut streets.....	1869
Vermont and Lee, Massachusetts.....	Fidelity block.....	1869
Vermont.....	G. W. Childs' private residence.....	1871
Lee, Massachusetts.....	Philadelphia Trust and Safe Deposit.....	1874
Vermont.....	Saint George's hall (except front).....	1876
	Baker building.....	1879
Lee, Massachusetts.....	New city buildings.....	Unfinished.
Serpentine, Chester county.....	Beth Eden church.....	1868
	University of Pennsylvania.....	1871
	Memorial Baptist church.....	1874
	Holy Communion church.....	1875
	Girls' normal school.....	1876
	Academy of Natural Sciences.....	1876
Ohio sandstone.....	Young Men's Christian Association.....	1868
	Academy of Fine Arts (trimmings).....	1870
	Residence of Bloomfield Moore.....	1875
	Girls' normal school (trimmings).....	1876
	Academy of Natural Sciences (trimmings).....	1876
	Second Reformed Episcopal church.....	1878
	Horticultural hall (trimmings).....	1881
	New city building (trimmings).....	Unfinished.
	Saint Agatha's church, Roman Catholic (partly).....	
	Saint Luke's Episcopal church (partly).....	
Hummellstown, Pennsylvania, brownstone....	Academy of Fine Arts (basement).....	1870
	Holy Communion church (trimmings).....	1875
	Academy of Natural Sciences (basement).....	1876
	Philadelphia library (trimmings).....	1877
	Building corner Fourth and Chestnut (trimmings).....	1882
	Building corner Third and Walnut (trimmings).....	1882
	Building corner Fifth and Walnut (trimmings).....	1882
	Building corner Twenty-second and Walnut (trimmings).....	1882
	Building corner Eighteenth and Spruce (trimmings).....	1882

GRANITE.—The Moyamensing prison, built (1835) in gothic castle style, principally of Quincy granite, was probably the first building in Philadelphia in which granite was used. There is a streak of rust on the outside of the wall running down from each embrasure of the battlement, caused apparently by the streams of water directed through these openings in rainy weather. Parts of the wall protected from the streams of water retain their original color, a little dulled by time.

Among the most notable buildings of granite in Philadelphia are:

The new Masonic temple, Norman style of architecture, said to be the finest structure belonging to the order in the world. The porch is a very elaborate and ornate piece of work of Quincy granite.

The Ridgeway Library, Grecian architecture, situated in the center of ample grounds so as to be protected from injury by the burning of adjacent buildings—an advantage not possessed by some of the fine structures of granite here.

Memorial hall, erected to commemorate the one hundredth anniversary of the independence of the United States, is of the modern renaissance style of architecture, and cost \$1,500,000; it has also extensive grounds surrounding it in Fairmount park.

The new post-office building on Chestnut street, a most beautiful structure of the French renaissance style, is approaching completion, and will cost when finished about \$4,000,000.

The particular kinds of granite from which the buildings above mentioned are constructed are given in a list of the granite buildings. Cape Ann and Quincy are the kinds of granite most used in Philadelphia for general building purposes—the Quincy, which takes a superior polish, for the more ornamental work, and the Cape Ann for rougher work.

The polished red-granite columns in the fronts of many of the business and public buildings are mostly of Bay of Fundy granite; Maine, Quincy pink, and Aberdeen Scotch granite being also used to some extent for the same purpose. The bluish-gray polished columns are of Quincy granite. Concord, New Hampshire; Westerly, Rhode Island; Dix island, Maine; Richmond, Virginia, and other points have also furnished considerable of that material for general building purposes in Philadelphia.

CONNECTICUT BROWNSTONE.—That portion of the Philadelphia County prison formerly used for the debtors' department was built about 1835, of Connecticut brownstone, and is among the first, if not the very first, instance of its use as a building material in Philadelphia. The nature of the stone seems to have been but little understood by the builders, as the blocks are nearly all set on edge, evidently for the purpose of making the material "go" as far as possible, as well as to facilitate the dressing. The blocks are exfoliating and separating into layers. Occasional blocks set the bedway are still sound. Experienced builders here say that this stone should be quarried before the winter, so that it may receive a certain seasoning, in order that the frost acting on the natural dampness within a block on being first quarried may not disintegrate it. In the old Masonic temple, Chestnut street, built of Connecticut brownstone in 1853, the rather slender carved ornamentation of the cathedral style of architecture at the top of its front had to be removed on account of its falling off piece by piece. This disintegration was probably due to the exposed position at the top of a high building and to the slender character of the work.

The principal use of this stone here has been for fronts of private residences, three-fifths or more of the fine stone fronts of private residences on Walnut, Chestnut, Spruce, and other principal streets being of this material. One of its most noticeable characteristics is the fresh, new appearance which it always retains, and in buildings here, where the material has been handled properly, it has shown itself to be substantial and durable. It is estimated that, including the Trenton, New Jersey, and the Yardleyville and Hummelstown, Pennsylvania, with the Connecticut brownstone, the geological formation to which they all belong (generally ascribed to the Triassic period), has furnished the material for about one-fourth of the whole number of stone buildings now standing in Philadelphia. The materials from this formation quarried at the different places above mentioned, and used in Philadelphia, though having some characteristics in common, are widely different in some respects. The Connecticut stone is of a lively and pleasing reddish-brown color; that from Trenton, New Jersey, and Yardleyville, Pennsylvania, known as the Trenton brownstone, is of a dull, grayish-brown color, and the Hummelstown stone a peculiar bluish-brown. The Trenton brownstone has been much used here for rubble work in the walls of school buildings and churches, and for foundations. The facility with which it is transported by water down the Delaware favors its use.

The Hummelstown brownstone, the hardest and most compact of all these brownstones, has been introduced here within the last fifteen years, and is used principally for trimmings in buildings of other stones and in brick buildings, giving a very pleasing effect. This stone as yet shows no evidence of disintegration in any of the buildings in which it has been used, and has the reputation here of being quite substantial and durable.

VERMONT AND MASSACHUSETTS MARBLE.—Though many of the more pretentious public edifices in this city were constructed before the introduction of the New England marbles, the most considerable of them all, the new city building now in course of construction, is of Lee, Massachusetts, marble, similar to that in the wings of the Capitol at Washington. Pennsylvania marble is used in some of its inner arched passage-ways, Ohio sandstone for some of its trimmings, Bay of Fundy red and Quincy granite for polished columns, and Richmond granite for foundation walls. It is estimated that the cost of this building when completed will be \$10,000,000.

The Fidelity block, Baptist Publication Society's building, Third National bank, private residence of G. W. Childs, esq., that of Dr. Jayne, the Philadelphia Trust and Safe Deposit building, Guy's hotel, and many other equally fine buildings, have been constructed of the Vermont and the Lee, Massachusetts, marbles during the last twenty years. Quite a large proportion of the Vermont marble used here is for trimmings of houses and for monumental and other cemetery work.

OHIO STONE.—Ohio stone, as it is called here, quarried in the Berea grit of the sub-Carboniferous period, at Amherst, Berea, and other places in northern Ohio, has been much used in Philadelphia for fronts of private residences and for trimmings and ornamental work. The Young Men's Christian Association building, the Second Reformed Episcopal church, pyramid of the Gardel monument in Mount Vernon cemetery, and canopy over the soldiers' monument at Girard college are some of the structures of the Ohio stone in Philadelphia.

CHESTER COUNTY SERPENTINE.—The green serpentine of Chester county, Pennsylvania, was quite popular in Philadelphia a few years back, and was extensively used in the construction of churches, school buildings, and private residences, especially in West Philadelphia. It is proving here to be substantial and durable, but there is much difference of taste concerning its color and general appearance. It is customary to trim buildings of the serpentine with brownstone, Ohio, and other building-stones. The buildings of the university of Pennsylvania are the most extensive constructed of this stone.

FOREIGN BUILDING STONES.—Foreign building-stones have not been used in Philadelphia for outside work except in rare instances. There is a front on Walnut street of red sandstone from Carlisle, England, and colored Italian, Lisbon, German, and other foreign marbles have been used slightly for inside ornamental work; the principal part of this work, however, is of Tennessee marble, with some Lake Champlain marble. Occasionally a block of fine statuary marble is imported from Carrara, Italy, and for cemetery work the Serivezzia Italian marble is quite extensively used, though it has been rapidly giving place to the Vermont marbles.

The Pictou sandstone, quarried in Nova Scotia and New Brunswick, a stone resembling the Ohio very much in color, is not at present used in Philadelphia, though a number of business houses and private residences were built of it between 1850 and 1860.

USE OF VARIOUS STONES.—The following estimates received from the most reliable sources accessible show approximately the extent to which some of the principal building stones have been used in Philadelphia during 1881:

	Cubic feet.
Granite.....	250,000
Marble.....	135,000
Serpentine (Chester county).....	50,000
Connecticut brownstone.....	25,000
Pennsylvania marble.....	25,000
Italian marble (cemetery work).....	25,000
Hummelstown brownstone.....	21,000
Ohio sandstone.....	20,000

The following are estimates of the amounts of some of the principal stones used for paving, rubble work, foundations, inside ornamental work, etc., in Philadelphia during 1881:

North River blue-stone (Pennsylvania and New York), used for sidewalk paving.....	square feet..	1,000,000
Conshohocken limestone, foundations and bridge abutments.....	cubic feet..	200,000
Schuylkill gneiss, foundations and rubble work.....	do.....	150,000
Trenton brownstone, foundations and rubble work.....	do.....	75,000
Vermont colored marble, inside ornamental work, tiling, etc.....	do.....	4,000
Tennessee marble, inside ornamental work.....	do.....	2,500

Of the 10,518 stone buildings, including those with stone fronts, within the present limits of the city, it is estimated that about one-fifth of the number are constructed of Schuylkill gneiss; one-fifth of Pennsylvania and New England marble; one-sixth of Connecticut brownstone; one-twelfth of Trenton brownstone; one tenth of Chester County serpentine; one-tenth or less of granite; and the remainder of Ohio sandstone, Hummelstown brownstone, Pictou sandstone, and a few others. Owing, however, to the number of large public buildings, such as the Girard college, new city hall, custom-house, mint, naval asylum, etc., in which marble has been used, and to the custom of trimming brick buildings with marble, the quantity of that material used is probably much greater than that of any of the others mentioned.

Granite being the material used in many large structures, such as Memorial hall, new post-office, Masonic temple, and Ridgeway library, the quantity of it used here will also reach a high figure.

The estimates of the number of buildings of each kind of stone, though carefully made, cannot lay any claim to accuracy, but it is believed that with other data given they are sufficiently close to give a good general idea of the extent to which those materials have been used for purposes of construction in Philadelphia.

Cemeteries.—For the better class of monumental and other cemetery work Vermont marble, Italian marble, and granite from various places are all extensively used in Philadelphia.

The use of granite for the more expensive monuments is steadily gaining ground; Quincy, Cape Ann, Fox Island, Hallowell, Westerly, and Richmond granites are some of the stones used.

Montgomery County or Pennsylvania marble is extensively used for bases, curbing, coping, inclosures, etc., and occasionally for monuments.

Schuylkill gneiss is used to some extent for the rougher parts of the cemetery work. Ohio stone and Connecticut brownstone are used in a few instances for monumental work.

Among the most notable of the many elegant monuments and tombs in the different cemeteries are: The Kane tomb at Laurel Hill, in which lies the body of the celebrated Arctic explorer. It is excavated in a bed of the Schuylkill gneiss and faced with massive granite blocks in Egyptian style. The monument to T. Buchanan Read, at Laurel Hill, a polished granite monolith 30 feet in height; the Gardel monument, in Mount Vernon cemetery, consisting of a pyramid of Berea, Ohio, stone, with life-size statuary, executed at Bruxelles; the Drexel mausoleum, of marble, in Woodlands cemetery; granite shaft in Woodlands cemetery to Admiral Charles Stewart.

In the church-yard of the Old Swedes' church the first tombstones were of soap-stone quarried at Wissahickon, on the Schuylkill, a short distance above Philadelphia. Several of these stones yet remain, bearing dates from 1708 to 1773, and the inscriptions are yet quite legible in most instances, while many of the inscriptions on the marble stones of much later date are effaced. The process of decay in the case of the old marble head-stones appears to be by the dissolving of the carbonate of lime by exposure to the weather, leaving a rough surface, caused by the projection of the more siliceous particles, which finally fall off; the process is repeated, and in time the inscriptions are effaced. Some of the fine marble monumental work of late years in the new cemeteries is protected by canopies of stone.

The soap-stone was also used for tombstones in the yard of Christ church contemporaneously with its use in the Old Swedes' church, and it may be stated that the same material was used for steps, trimmings, etc., until the Pennsylvania marble was introduced for those purposes in the latter part of the last century. The soap-stone was used for trimmings in Christ church, the old state-house, and other buildings of an early date. It is soft and easily wrought, but is of unequal hardness on account of having lumps of imperfectly-crystallized serpentine in its composition, causing it to wear unequally, hence it was rejected as soon as the better-adapted Pennsylvania marble came into use.

The graves of Benjamin Franklin and his wife Deborah, in Christ Church yard, Arch street, have a plain horizontal slab, apparently of Hitner's white Pennsylvania marble, bearing simply the names of the deceased. The stone is undergoing the same process of decay as the other old marble tombstones before described.

Bridges.—The Delaware not being bridged at Philadelphia, on account of the interference it would offer to navigation, the bridge work is confined to the Schuylkill.

In Christian Street bridge Cape Ann granite is used; Girard Avenue bridge, Maine granite; Fairmount bridge, Fox Island granite; Pennsylvania Railroad bridge, Girard avenue, partly of Trenton brownstone—granite and Schuylkill gneiss being also used. Conshohocken limestone, Port Deposit stone, and Conewago granite (trap or diabase) from near Harrisburg have also been used in bridge abutments. The Schuylkill gneiss was the first material used here for the construction of bridge abutments.

Roofing.—Slate for roofing is quite extensively used in Philadelphia, there being abundant supplies of the material within easy reach. Lehigh slate from Lehigh and Northampton counties, and Peach Bottom slate from York county, near Mason and Dixon's line, are extensively used.

The Lehigh slate quarried from strata of Hudson River age resting on the Siluro-Cambrian formation of the great valley known in different parts of it as the Kittatinny, Cumberland, or Shenandoah, is the least expensive and most extensively used. The Peach Bottom slate of Archæan age, of excellent quality as roofing slate, is much used for roofing the better class of buildings.

Street paving.—On the 24th of November, 1718, the common council resolved that—

Whereas several of the inhabitants of the city have voluntarily gone into the paving of ye Kennel to the middle of the streets before their respective tenements with pebble-stone, and many are leveling to follow their example. But for as much as what is already done is very much damified by the excessive weight of carriages, and will be every day more and more, unless some means are speedily taken to prevent the same, an ordinance is brought to prevent the cartmen and others their carrying such excessive loads.

We learn that the first regular paving of a street was due to an accident. A man on horseback being mired and thrown from his horse, breaking his leg, a subscription was raised and the street paved with pebbles from the river bank. In 1719 many sidewalks were being paved with brick, and the cartway with cobble-stone.

In 1750 the grand jury represented the great need of paved streets, "so as to remedy the extreme dirtiness and miry state of the streets"; but the first general effort worthy of mention to pave the streets was made in 1761-'62, and even then the only means applied to the purpose was that produced by lotteries.

The extreme inconvenience of unpaved thoroughfares was much felt from the beginning, and such old records as are now accessible show that frequent spasmodic attempts to remedy the defect were made, but for a long time little was done, and that little not of a substantial or permanent character.

Some of the streets had their channels or gutters in the middle. In cases where the streets were elevated and had a gutter at each side, they were defended by posts, curbstones not having yet come into use.

The first curbstones were set in Water street, from High street (now Market) to Arch street, about 1786-'88. They were of the Schuylkill gneiss, and some of them yet remain, though in a much worn and battered condition.

For the middle of the street, cobble- and rubble-stones continued to be about the only material used until 1848, when cubical blocks of granite having an edge of about a foot began to be introduced; Chestnut street in front of the custom-house and post-office was paved with the cubical blocks about this time. For some years these large cubical blocks were quite popular for paving purposes. In 1852 an ordinance was passed requiring owners of lots to set heavy granite curbstones between the sidewalk and street where paved with cubical blocks.

In 1854 the mayor was authorized to expend \$50,000 in paving streets with the cubical blocks. The cubical-block pavements, though unsurpassed in regard to solidity and durability, soon came to be objectionable, since the surface of the large blocks wore smooth, and hence afforded but an uncertain foothold for horses. This difficulty was sought to be remedied by using small (Belgian) blocks 4 inches square, and a secure foothold for horses was thus obtained, but experience soon showed that with a width of about 4 inches the length of the block might be increased to a foot or more, thus securing a more solid pavement without sacrificing any other merit.

Some of the cubical-block pavement, so much of which was laid when in the zenith of its popularity, about thirty years ago, still remains in Chestnut and some other principal streets.

The following statistics were obtained at the office of the commissioner of highways and from other reliable sources:

Number of miles of paved streets in Philadelphia	900
Number of miles of unpaved streets in Philadelphia	1, 100
Number of miles of granite-block pavement	50
Number of miles of cubical, Belgian, etc. (estimated)	2
Number of miles of cobble-stone pavement (estimated)	600
Number of miles of rubble-stone pavement (estimated)	248
Number of miles of pavement of Cape Ann granite (estimated)	44
Number of miles of pavement of Richmond granite (estimated)	3
Number of miles of pavement of Port Deposit gneiss, Schuylkill gneiss, Jersey City trap, North River blue-stone, etc. (estimated)	5

It will be seen by the above statistics that cape Ann, Massachusetts, is the main source of supply for granite blocks. The blocks are shaped at the quarry and shipped here by water.

Each of the principal street railways, by a late ordinance, is required to pave with granite blocks one mile of the street through which it runs; and this is the style of pavement now preferred.

The standard size of this block, 12 by 4 by 6 inches deep, is not rigidly adhered to with regard to the length, the blocks generally varying from 8 to 14 inches in length. Experience has shown that if the width be kept at about 4 inches and the block laid crosswise of the street, a sufficiently good foothold is secured for horses, even though the length should vary considerably. The practice here is to have the block about 4 inches wide, from 8 inches upward in length, and 6 or 7 inches in depth; blocks of these dimensions laid on a bed of gravel seem to give the most satisfactory results.

Sidewalk paving.—The sidewalk paving is left to private enterprise, each owner of a lot paving the sidewalks opposite to it according to circumstances. Brick is the main dependence for this purpose, though North River blue-stone is used almost exclusively for the better class of sidewalk paving. The North River blue-stone is now obtained, not only from Ulster county, New York, and neighboring districts on the Hudson, but from Pike county, Pennsylvania, where beds of flagging of the same formation, and equally well adapted to the purpose, have lately been developed.

The North River blue-stone has the reputation here of being perfectly adapted to the purpose of sidewalk paving. It is readily quarried in flags of the required thickness; the surface is even, the material so hard that there is no perceptible yielding to foot-wear, and there is a peculiar grit that prevents the surface from becoming slippery. It is estimated that there are 100 miles of stone sidewalk paving in the city, the greater part of which is of this stone, which was introduced here as early as 1835, or thereabout. During 1881 about 1,000,000 square feet of North River blue-stone was used in Philadelphia for sidewalk paving, and thicker layers of the material are used to some extent for trimmings of houses. The estimate given includes stone brought both from the New York quarries and from those near Pond Eddy and Shohola, in Pike county, Pennsylvania.

The sidewalks in front of some of the larger business houses on Chestnut street are paved with large flags of Cape Ann, Richmond, and other granites, which flags serve also as vault covers. It is found necessary to "ridge" the granite flags, as otherwise they become so slippery as to afford but an insecure foothold for pedestrians.

Slate from Lehigh county, Pennsylvania, has also been made use of to some extent for sidewalk paving. A good example of its conduct when used for flagging is seen in front of Independence hall, where the material is used. Such parts of the pavement as remain whole have a very even surface; but the slates, being laminated or in layers adhering together, are rapidly shelling or separating into thin plates by the action of water and frost.

The Wyoming blue-stone is also used for sidewalk paving to a limited extent, but the flags from the upper layers of these quarries are generally laminated, and, like the Lehigh slate, are disintegrated by water and frost, though the lower layers furnish material free from this objection, and which is in every way excellently adapted to the purpose of paving. The best curbstones in use here are of granite about 8 inches wide, 2 feet deep, and from 6 to 10 feet and upward in length.

Asphalt is but little used for paving in Philadelphia, and is mostly confined to some walks in Fairmount park, and a few small areas laid by private individuals.

PITTSBURGH, PENNSYLVANIA.

Several important buildings were constructed of the local stone (Morgantown sandstone of the *Second Geological Survey of Pennsylvania*), quarried within the limits of Pittsburgh, before its destructible nature was understood. The stone in all these buildings is being rapidly disintegrated by the action of the atmosphere. The native stone, however, in the construction of by far the greater part of the cellar and other underground work, is still used, and is thought to be durable when protected from the atmosphere.

Sandstone from Baden, Beaver county, Pennsylvania, a material easily dressed and durable, is largely employed for foundations, caps, sills, etc. The color of this stone is locally called "pepper and salt", owing to the presence of little brown specks of iron oxide throughout it. This characteristic renders it readily distinguishable from other Beaver County stones; its texture is rather coarse. Sandstone from Homewood, in the same county, is largely used for bridge abutments and for other rough building purposes. It is hard to dress, and hence is not a favorite where fine work is required. It is a durable stone, resisting the action of the atmosphere quite well. The Homewood sandstone is a well-known horizon of the Lower Coal Measures.

The quarries at Freeport, Pennsylvania, which formerly furnished considerable building stone at Pittsburgh, are not operated at present; however, near the last-named place, at Lucesco, Westmoreland county, there is a quarry which is beginning to furnish some stone for cellars and foundations at Pittsburgh. Some of the street paving stone and most of the sidewalk paving stone is brought from flag quarries on the Monongahela river, in Allegheny and Fayette counties. It is a very hard bluish-colored material, which comes out in convenient shape for flagging, and resists quite well the kind of wear to which it is subjected. One of the principal sources of paving blocks is Banning's quarry, near Connellsville, Fayette county. One or two churches and business blocks are built of Massillon sandstone, which is used to a considerable extent for finer grades of work.

The Smithfield Street German church, constructed of Massillon sandstone, shows signs of crumbling in one or two places. This church was constructed with two disconnected walls side by side; the outside one very thin and with many of the stones on edge, the inside one undressed and carelessly put up. This is but one of many instances in which a stone suffers by being improperly handled rather than through defects in the material itself.

The Ohio sandstone is employed to some extent for the more ornamental stone-work. The Allegheny court-house, built of the Morgantown sandstone quarried in the vicinity, the stone in the walls of which was rapidly disintegrating, was lately burned. The atmosphere of Pittsburgh is severe on building stones. In the large number of iron and other manufacturing establishments an immense amount of bituminous coal is consumed, and a cloud of sulphurous smoke continually envelops the city. At times the fog is so dense that gas must be lighted during the day.

There are two or three buildings constructed of Niagara limestone from Lemont, Illinois, and there is one building—the Dollar Savings bank—with a front of Connecticut brownstone. The streets are largely paved with stone, and besides the paving blocks already mentioned, which are used for the better class of street paving, cobble-stones from the Allegheny river are more extensively used for that purpose than any other material. There is considerable stone sidewalk paving, though brick is generally used for this purpose. For the portions which are of stone, flag-stone from points in Allegheny and Fayette counties is chiefly used. Flagging from Warren, Ohio, is also used to some extent; also sandstone from Baden and Homewood, in Beaver county. The wharves are constructed of cobble-stones taken from the bed of the Allegheny river. The abutments of several of the older bridges across the Allegheny and the Monongahela rivers are built of the native stone quarried within the limits of the city of Pittsburgh. Bridge abutments are now built of the massive sandstones from Beaver and Homewood. Sawmill Run wall, which holds up the embankment of the Pittsburgh, Cincinnati, and Saint Louis railroad, along the south bank of the Monongahela river, is built of a sandstone similar to the local stone from the railroad company's quarry near Walker station, Allegheny county. For all first-class cemetery work granite is preferred, owing to the peculiar severity of the atmosphere.

PITTSFIELD, MASSACHUSETTS.

The following is a list of stone buildings in Pittsfield, with the materials of which they are constructed: The Berkshire County court-house, of white marble from Sheffield; the public library, of Longmeadow granite; the house and barn of Mr. Thomas Allen, of Quincy granite; one house built of limestone from New York; farm-house of Mr. A. A. Rice, of cobble-stone found in the vicinity.

There are no important quarries here, and surface stone, stated by Professor C. H. Hitchcock to be of Cambro-Silurian limestone of the Berkshire valley—called the Stockbridge limestone by Professor Emmons—is found in the vicinity and is used for foundations and underpinnings. There are also some small limestone quarries from which the material is obtained for these purposes. The soil everywhere is full of rough limestone blocks of quartzite—cobble-stone of Potsdam sandstone age, according to Professor Hitchcock—and where cellars are dug much of the stone taken from the excavations is broken and used for the walls. In many places in the vicinity the limestone ledge crops out, but has never been quarried to any great depth. The streets are not paved with stone, excepting the gutters, which are usually paved with cobble-stones. The sidewalks of about half a mile of the business streets are paved with North River blue-stone, and the remainder of the sidewalks with concrete. The curbstones are a blue flagging, said to have come from Catskill, with some limestone from a local quarry.

PORTLAND, MAINE.

The material chiefly used for the better class of work is granite from Hallowell, Biddeford, Spruce Head, and Yarmouth. Next in importance is the Nova Scotia sandstone, used for fronts. There are four churches built of material obtained from rough granite boulders found in the vicinity of Portland; one building is of Vermont marble. Stone for foundations, cellar walls, and work of that class, is rough granite boulders obtained in the immediate vicinity of the city; underpinnings are of granite from Biddeford, Yarmouth, and Spruce Head; in the steps, posts, and basements of better houses, the following granites appear to have been used: Spruce Head and Biddeford, quite extensively; also Portsmouth, and Hallowell granites; Yarmouth and Hallowell granites are used in fronts, sills, and trimmings. The Spruce Head granite is especially conspicuous by its patches and its freshness even after a long exposure. One old building is fronted with Quincy granite. The granite from the Maine Central quarry at North Jay has been used only in the trimmings of the Maine Central Railroad office. Iron railings in the elaborately-wrought granite supports invariably discolor the blocks; even the smallest piece of iron at a considerable height discolors everything below it. Part of the breakwater in the harbor is built of granite from Mount Waldo and Bluehill. Forts Preble, Gorges, and Scammel are of granite from Mount Waldo, Biddeford, Spruce Head and perhaps other places. The post-office is a large and beautiful building of Vermont marble, with fluted columns, and considerable carved work, the best being of Hallowell granite. The custom-house is a very beautiful granite building of Hallowell and Concord granite, the main building being of Concord, while the towers are of Hallowell granite.

The city hall, quite a large structure, has a front of fine yellow sandstone from Nova Scotia and a basement of granite. Several churches and the Emory block are built of granite, chiefly from Hallowell; also, some are built of irregular pieces of sappy slate and mica-schist picked up in the vicinity of Portland, with granite trimmings; one or two of these have square blocks of quarried granite interposed, which give them a peculiar appearance. The Centennial block has a front of red and yellow Nova Scotia sandstone, and two beautiful polished granite columns of material from Red Beach, Maine. The county jail is built of Biddeford granite. Stone is now used exclusively in paving such streets as are paved, and the material formerly used for this purpose was cobble-stones from Cranberry islands and East Maine; the material now used is granite blocks from Yarmouth, Hallowell, and Fox island. There is a small amount of stone in sidewalk pavements, of Hudson River flags, but brick is the material chiefly used for paving. The curbstones are of granite from Falmouth and the vicinity of Portland usually, but granites from Yarmouth and Hallowell, and some from Spruce Head, were so used.

POTTSVILLE, PENNSYLVANIA.

Pottsville is very picturesquely situated close to the foot of the mountains and partially on their sides, all of the ground on which the city is situated being uneven, thus making considerable stone-work necessary for bringing the bases of buildings to a level, and also for terrace walls and other purposes necessary in cities built on very uneven ground. Montgomery County marble has been used to some extent for steps, base courses, sills, and other trimmings; also some Vermont marble for the same purposes. Ohio sandstone was used for trimmings in the *Miners' Journal* building, a fine structure of brick. New England granite has been used in a few important business buildings for steps. Goldsboro' brownstone is used in two or three buildings for trimmings; it approaches Connecticut brownstone in color more nearly than does the Hummelstown of the same formation.

In several buildings the bad effects of placing the stone edgewise instead of the bed way are manifested by the disintegration of the material. Edging proves to be particularly injurious to the brownstone—less so in the case of marble, still less so with the Pottsville conglomerates and laminated granites; but it is desirable to avoid the practice in all cases, as experience proves. The Henry Clay monument, on the side of the hill above the *Miners' Journal* building, is of iron with base of Pottsville conglomerate, a material abundantly exposed near Pottsville. The largest stone structure in the city is the Schuylkill County prison; the front of this building is of Trenton brownstone of Triassic age; the architecture is of the castellated style, and the side and rear walls are constructed of Pottsville conglomerate.

For cemetery work New England and Italian marble, brownstone occasionally, and some granite, have been used. Besides the stone buildings enumerated there are about 200 buildings with considerable stone in their structure in the way of base courses, caps, sills, lintels, and steps. Hummelstown brownstone has been the stone chiefly used for trimmings, it being easier of access than any other stone good for that purpose; it proves here to be substantial, durable, and in every way satisfactory for trimmings. A large rectangular block of this stone was observed serving as steps in front of a business house; although it has been in place twelve years and subjected to continued foot-wear, but little impression has yet been made on it.

None of the streets are paved with stone. The city is so situated that there is perfect drainage in almost all parts, and the gravelly nature of the soil is such that the streets are naturally firm and the need of paving them with stone is not urgent. There is, however, considerable stone sidewalk pavement, chiefly of the sandstone quarried in the vicinity. The North River blue-stone is used to a limited extent for the same purpose. The curbstones are of the native Pottsville conglomerate. The abutments of the small bridges needed are of Pottsville conglomerate. The slate roofs are principally of Lehigh County slate.

POUGHKEEPSIE, NEW YORK.

Stone found in the vicinity of Poughkeepsie, either in small quarries or in excavations of various kinds, is a hard blue limestone suitable for rough work only. As to durability, however, it is indestructible by the ordinary action of the elements. The only stone used here that has shown signs of disintegration is the brownstone, much of which comes from Connecticut. Sills and lintels of this material show signs of disintegration after the lapse of years. Besides the materials already mentioned as used in stone construction, limestone from Westchester county, Ohio sandstone, and gneiss from the vicinity are employed. For foundations and underpinnings hard, blue limestone and other rocks from the small local quarries and from various excavations are used; for underpinnings dressed sandstone and blue-stone are used to a limited extent. Two and a half miles of the principal streets are paved with large cobble-stones, and there are 300 feet of Belgian block pavement. Sidewalks are largely paved with stone, and the material used for this purpose as well as for curbing is the North River blue-stone. Blue-stone and boulders are used in the construction of buildings, docks, wharves, and bridge abutments.

PROVIDENCE, RHODE ISLAND.

The foundations in the city of Providence are generally from the so-called ledge stone from the great quarry in Cranston and smaller ones in North and East Providence, a slate of great strength in resisting strains. It is very hard to break across the grain. In digging for foundations in this city miry ground is occasionally struck, and quicksand is often encountered. The great length of blocks attainable and the strength of the slate make it very serviceable for filling up such ground, because the slate does not break into smaller pieces by the strain upon it. In the case of the Providence gas-house the reason given for making the dome of great size is said to be the desirability of relieving the pressure on the lower parts of the building on account of the unfavorable condition of the ground. In the older buildings the Quincy granite and Connecticut sandstone are chiefly used for underpinnings, especially the latter; and the Nipmuck stone and Smithfield granite are also used to a considerable extent for this purpose. The other granites were brought into use lately, and have been extensively employed also. In one or two houses a blue-stone, probably of Hudson River age, has been used. As regards the sidewalks, Providence uses much concrete. The Bolton, Connecticut, flags were once employed very extensively and are still found, but none are sold now in the city. Very often there exists in them tongues of harder rock in the soft blue schist, and by the wearing of frost and water the stone becomes grooved in a very peculiar manner, with the tongues standing out as ridges. This softness and want of homogeneousness must be serious defects. In old times large amounts of crossings, flags, and even curbs were hauled into the city from Nipmuck ledge, from near Coventry; they are distinguished from others by their yellow look. The same stone has been used in some old dwelling-houses; it has quite a large proportion of muscovite, with much less biotite in layers, and hence splits quite smoothly, so that it is designated by Providence architects as "natural face" stone. Trimmings of white and blue Vermont marble are used in one or two buildings, and artificial stone has also been used. Tuckahoe dolomite is used in one front and for trimmings in one or two buildings, and two old posts before a house are capped with this same material. There is a great tendency in the newer buildings to use fine red brick with yellow sandstone trimmings. The finest stone structure in the city is the new city hall. It is built of Hurricane Island, Westerly, and Concord granites. The basement up to the pencil mark is of Hurricane Island granite; above this the front and right sides are all Westerly except the columns, which are Concord granite; the back and left sides above the basement are Concord granite. The granite slabs on the sidewalk of the new city hall, obtained from the Cape Ann Quarry Company, are claimed to be the largest granite flags quarried in this country. The dimensions are from 22 to 23 feet long, 5½ to 8 feet wide, and 1 foot deep; some are from 10 to 12 feet wide, but the width is usually less. These different granites harmonize perfectly. The building is said to have cost \$1,400,000. Polished columns of Westerly granite support the lamps. The stone in the soldiers' and sailors' monument in front of the city hall is of Westerly granite; the United States post-office and custom-house of Quincy granite; the Providence athenæum has front and columns of Quincy granite and sides of Smithfield granite. In front of it is a very beautiful drinking fountain, said to be of light Concord granite, and two handsome polished columns of Quincy pink granite. The new court-house just opposite is a magnificent brick building extensively trimmed with red sandstone, partly carved, and in the entrance stand six polished columns, two of red Westerly, two of blue Westerly, and two of Diamond Hill granite. The arcade runs from street to street, and was erected in 1828. The twelve large columns are made of Smithfield granite, and must have been a large undertaking at that time.

The high school is of brick with yellow sandstone trimmings; it has a high basement built of Westerly granite and polished columns of red Westerly and Quincy pink granites; the Roger Williams monument is of Westerly granite; the new Catholic cathedral, the most imposing stone building, is entirely of brown sandstone from Portland, Connecticut; Grace church is built of Little Falls, New Jersey, sandstone; the First Congregational church is of granite from Smithfield; All Saints' Memorial church and Saint Stephen's church are of Connecticut brownstone; Saint Mary's church is of granite from Westerly, Diamond Hill, and Northbridge; the Central Congregational church is of Connecticut brown sandstone; Sayles Memorial church at Brown's university is of red Westerly granite trimmed with Connecticut brown sandstone; Saint Xavier's academy is an old stone building made of material from Nipmuck ledge, Coventry, Rhode Island; the Providence Savings institution was built twenty-seven years ago of Quincy granite; there is a handsome private residence near the Friends' school-house built entirely of cut red and white Westerly granite; Saint Patrick's church is built of rough stone from the vicinity; the gateway of the North burial-ground is built of Diamond Hill granite; in Grace Church cemetery the posts, coping, etc., are made of West Greenwich granite; the Dexter asylum has an immense stone wall of natural-faced stone from Nipmuck, in the vicinity of Providence; the old state prison is built chiefly of Quincy granite; the Burgess building is fronted with Tuckahoe dolomite; the Richmond building is of brick trimmed with olive sandstone, and has red and gray polished granite columns; the Wilcox building has some carved and polished work of Westerly granite in its composition; the Aldrich house has a front of white limestone which came from the city of Montreal, Canada; each block was sent on dressed into the proper shape and numbered. This quarry is said to be within the limits of Montreal. Saint John's church is built of bowlders and natural-faced stone from the vicinity of Providence; the building is trimmed with red sandstone. The College Library building of Brown university has a basement of Sterling granite; it is built of brick trimmed with yellow and blue sandstone. There are also red

and gray polished granite columns, probably from Red Beach, Maine, and Diamond Hill. The granite in the pumping-station is from Westerly; there are two wharves in which granite was used extensively; in one the material is from Diamond Hill and the other from Pascoag, Rhode Island.

There are 135 miles of recorded streets; 16 miles of this length are paved with granite blocks and cobble-stones; the material is from Diamond Hill and Westerly, Rhode Island, from Connecticut, and some from Maine granite quarries.

The sidewalks are but little paved with stone, concrete being usually the material employed for this purpose. In such sidewalks as are paved with stone the Hudson River flags are used, with occasionally granite from Diamond Hill and Smithfield, gneissoid granite from Nipmuck, Rhode Island, and flags from Bolton, Connecticut. The curbstones are of granite from Diamond Hill, Smithfield, Westerly, and Nipmuck; and Hudson River blue-stone is used to a limited extent for this purpose.

QUINCY, MASSACHUSETTS.

The seven stone buildings in this place are constructed of Quincy granite. All the stone used for building is obtained from the quarries within the city limits. The streets and sidewalks are not paved with stone, but there are some curbs of the material from the local quarries. Among the important stone buildings are the town hall, the Unitarian church, and the school building.

READING, PENNSYLVANIA.

Quarries of the Siluro-Cambrian formation are operated within the limits of Reading for local building purposes. The material at this point, however, is used only for the rougher building purposes, such as foundations, underpinnings, etc. Stone is not used to any great extent; there is an abundance of brown sandstone south of the town, the northern edge of the formation which furnishes the brown sandstone passing within a short distance of it. No extensive quarries of this material are being operated in the neighborhood; what stone is needed for local use in Reading and vicinity is obtained from the surface boulders. Much of the material in this locality is a conglomerate, and only the surface boulders have as yet been made use of; consequently the stone, well seasoned and tested by the weather before being used, proves to be durable. The buildings of this sandstone are usually in a good state of preservation. For the better class of stone construction Hummelstown brownstone is the material most used. The stone used for bridge abutments and arches is the brown sandstone already mentioned; none of the streets are paved with stone; some of the sidewalks are paved with Hudson River blue-stone, but the amount is small. The curbstones are made of local limestone and Hudson River blue-stone. Bricks of good quality are manufactured in the vicinity, and the Philadelphia pressed brick is also being largely used.

RICHMOND, INDIANA.

Stone is but little used in the construction of buildings in Richmond, and is chiefly confined to foundations; the material employed for this purpose is the Cincinnati blue limestone, outcrops of which are found along a creek in the vicinity. The stone from this formation at nearly every point where it is exposed or quarried shows itself to be lacking in the important quality of durability, and its use here has demonstrated that after a comparatively short exposure to the atmosphere it begins to weather. The ground on which the city is built furnishes secure foundations, and there are no conditions of topography or of climate that are especially unfavorable to the extensive use of stone as a building material, although the stone from the Cincinnati formation quarried in the vicinity is used for foundations and for the ruder purposes generally; the twenty stone buildings are constructed of Berea, Ohio, sandstone of sub-Carboniferous age. The streets are not paved with stone, and the sidewalks but very little; the material used in such streets and curbing as are paved is limestone from New Paris, Ohio.

RICHMOND, VIRGINIA.

There are but five buildings in Richmond constructed of stone, four entirely of stone and one front. In two of the buildings granite quarried in the vicinity is used; and in the walls of two buildings stone from surface boulders found in the vicinity is used, while one building is of Quincy, Massachusetts, granite. There is a one-story building on Main street, between Nineteenth and Twentieth streets, which has stood for more than a century; it is constructed of boulders of granite rock, and has no significance in an inquiry concerning stones used in construction, except to show the durability of these boulders. The stone used in a church on Grace street was obtained from a quarry below the city, but it has been practically abandoned. The stone used in the custom-house came chiefly from the Old Dominion Granite Company, and there is scarcely any change perceptible in the material since it was laid in the walls of the building. The pedestal of the Washington monument is constructed of granite from the Tuckahoe district, Henrico county. The piers of the five bridges across the James river at Richmond were constructed of

stone quarried for the most part on the island in the river and along the right bank of the river not far from the ends of the bridge. There are several docks where this material is also largely used. The granite quarried near Richmond ranks with the best granites, and it has been used in the construction of many important public buildings throughout the country, notably the superstructure of the new State, War, and Navy Department building in Washington, District of Columbia. In the business portions of the city the streets are paved with cobble- and rubble-stones from the vicinity. The sidewalks are but little paved with stone, and the materials used are the mica-schist from Lynchburg, and North River blue-stone shipped from Rondout, New York. The curbstones are of the local granite.

ROCHESTER, NEW YORK.

The materials used in stone construction in Rochester are, for foundations and underpinnings, limestone from the local quarries, and to a limited extent sandstone from Ohio and from Albion, New York. For the better class of stone construction, Ohio sandstone, Medina sandstone from Albion, and granite and limestone from the vicinity, are all used. By far the larger number of stone buildings are constructed of limestone from the vicinity. For piers and work of that class done by contract Waterloo limestone is used. The streets are largely paved with Medina sandstone rock from Albion, New York; and there is considerable stone sidewalk, the material used being Medina sandstone and Hudson River blue-stone. Curbstones are principally of the latter.

ROME, NEW YORK.

Most of the buildings in Rome are of brick or wood—largely of brick. The foundations and underpinnings are built of limestone and sandstone quarried at Higginsville and Verona, Oneida county. For the better class of stone construction sandstones from Verona and Potsdam, New York, and limestone from Onondaga and Oneida counties are used. There is little stone street pavement; the material used is cobble-stone. There are about 12 miles of stone sidewalk pavements of sandstone from Cayuga county, New York, and Hudson River blue-stone. There is but little curbing.

RUTLAND, VERMONT.

As there are quite celebrated marbles quarried in the immediate vicinity of Rutland, that is the chief material used in stone construction. Considering the convenient source of supply for building stone the number of the stone buildings in the city is not large, there being only twelve constructed entirely of this material and one front of marble. The following are some of the principal stone buildings in the vicinity: Two mills at Sutherland Falls are built of marble quarried at that place; the Episcopal church is constructed of gray limestone; the Catholic church is of limestone taken from the lot upon which it is built; the old jail, now used as a dwelling, is also of limestone; the Chatterton dwelling-houses near Sutherland Falls are of limestone; Sheldon & Slason's 2 mills, store, and office are of West Rutland marble; the Catholic church, H. H. Brown's store and office, the mill of Gilson & Woodfin, and that of the Manhattan Company are of the same material.

The population of Rutland is scattered over a wide area, the principal village being comparatively small. The unusual number of stone buildings is due to the proximity of the marble quarries. This material is used not only for the better class of construction, but also for foundations and underpinnings, and for all ordinary purposes. The location of the quarries is north and west of the town. Slate from Fair Haven and Chester, Vermont, is also employed to a limited extent for foundations and underpinnings. The streets are not paved with stone, and about a mile of sidewalk pavement is of marble and slate, and a little of granite from Chester, Vermont. The curbstones are of marble, slate, and granite.

SAINT PAUL, MINNESOTA.

In the enumeration of stone buildings in Saint Paul every business front having separate numbers, though included in the same block with others, was counted as one building, and the number of stone buildings given in the tabulation includes every stone structure whether large or small. The use of stone in Saint Paul has exceeded that in Minneapolis on account of the ease of quarrying and its accessibility, and the comparatively greater cost of wood. The great lumber mills are at Minneapolis, and their products would have to be hauled by wagon or by steam a distance of ten miles to make them available at Saint Paul. The following is a list of Saint Paul buildings with materials of which they are constructed:

Structures with brick walls and Berea sandstone fronts.....	4
Structures with brick walls and Saint Paul limestone trimmings.....	208
Structures with brick walls and Kasota calciferous sand-rock trimmings.....	107
Structures with brick walls and Frontenac dolomite trimmings.....	49
Structures with brick walls and Fond du Lac limestone trimmings.....	7
Structures with brick walls and Berea, Ohio, sandstone trimmings.....	30
Structures with brick walls and Vermont marble trimmings.....	1
Structures with brick walls partly trimmed with Minnesota granite.....	27

The state capitol now in process of construction is to consist essentially of Red Wing pressed brick, with trimmings of the dolomite from Frontenac. At the base of the building one course of brown sandstone from Fond du Lac, Minnesota, will show about 10 inches; the unexposed part of the foundation is of the blue dolomite from the upper part of the Trenton formation, at Saint Paul, which is a much better stone than the beds of this formation that are usually quarried for building purposes. Some of the principal buildings of the city that deserve enumeration are the following: The market building, built of brick, trimmed with Kasota stone; Baptist church, built wholly of Kasota stone; the cathedral is wholly of Saint Paul limestone; the McMullen block and the Fire and Marine Insurance building are of Saint Paul limestone; the Drake business block is of brick, trimmed with Kasota stone and granite; the business block of Auerbach, Finch & Van Slyke, of brick, trimmed with Frontenac stone; the Manheimer business block and the German-American bank are of brick, with Ohio sandstone fronts; the Saint Paul Episcopal church is built of Saint Paul limestone; the United States custom-house is of Saint Paul limestone, with Saint Cloud, Sherburne county, granite trimmings; the Saint Paul rolling-mill is of Saint Paul rock, with Kasota trimmings; the Presbyterian House of Hope church and the piers that support the bridge over the Mississippi river are of Saint Paul limestone; the trimmings of Lindeke's, Warner & Sherman's, Barney's, Gilfillan's, and Odd Fellows' blocks are of the magnesian limestone from Frontenac, Goodhue county, Minnesota; the front of the Nichols & Dean block is of granite from Sauk Rapids, Minnesota.

The streets are but little paved with stone, wooden blocks having been chiefly used for this purpose. The sidewalks in the business parts of the city are very generally paved with Saint Paul limestone and granite from Minnesota, sandstone from Ohio, and the calciferous sandstone of Kasota. Curbstones are of the Saint Paul limestones.

SALEM, MASSACHUSETTS.

In the few buildings in Salem in which stone enters as an important ingredient, Cape Ann granite, Peabody granite, and Springfield sandstone are the materials used. Foundations and underpinnings are of Cape Ann and Peabody granites. There is considerable stone street pavement of Cape Ann and Maine granites. Sidewalks are not paved with stone, but the curbs are of Cape Ann and Peabody granites.

SALT LAKE CITY, UTAH.

The assembly house is built of Cottonwood granite, and the old tabernacle has piers of Red Bud sandstone. The new Mormon temple is to be constructed of the Cottonwood granite. On account of the greater cost, stone is used to only a limited extent; brick, adobe, and wood being well adapted to the climate and much less expensive than stone. Of the forty stone buildings in the city the Red Bud sandstone was used in the construction of over thirty, and three or four were built of granite quarried in Little Cottonwood cañon; and in such foundations as are built of stone these materials are employed, though bricks are chiefly used for foundations. The streets and sidewalks are not paved with stone.

SANDUSKY, OHIO.

The city of Sandusky has a much larger percentage of stone buildings than any other city in Ohio. Of buildings entirely constructed of stone it has absolutely by far the largest number of any Ohio city, owing to the cheap and abundant supply of good building stone within the limits of the city, which constitutes a great limestone quarry covered with but a very shallow layer of soil or earth. The stripping rarely amounts to 2 feet, and below there lie from 8 to 10 feet of easily-quarried, strong, and durable limestone of good color, and in every way adapted to all building purposes. In early days it was the cheapest building material accessible, and so came to be used in many of the houses first built in the city.

The white limestone that lies immediately below the blue is reached but in a single city quarry; this is a massive stone fit for dimension work and well adapted to cutting, but the great supply of it comes from Kelley's island and point Marblehead. The blue limestone from the city quarries is largely used in the construction of piers and docks in the vicinity, and also for flagging, but it is not very well adapted to this use; it is laid in blocks or slabs from 4 to 8 feet square, not very smooth until polished by wear, and then becoming dangerously smooth. The stone of the city all proves very durable and the best of foundations are secured at small expense. The Sandusky court-house is of the Massillon sandstone. The streets and roadways are chiefly macadamized with broken blue limestone.

SAN FRANCISCO, CALIFORNIA.

The first stone structures in San Francisco were two buildings erected in 1854, of granite brought from China, quarried and dressed in that country. In the years 1856-'57 the granite quarries of Folsom were opened, and the fronts of several buildings on Montgomery and Battery streets were constructed of it. In 1865 the Bank of California building was erected of a beautiful blue sandstone quarried at Angel island, in the bay of San Francisco; it holds its color and surface well. The earthquake of 1868 made some cracks in the walls and gave rise to the belief that the

stone was weak, and that stone in general was not fitted for use in this region. The United States mint has a basement of granite and walls of sandstone, from New Castle island, in the gulf of Georgia, British Columbia. There are six fluted columns, 27 feet high by 5 feet 6 inches at the base and 4 feet 6 inches at the top, of New Castle sandstone. The new city hall is the most extensive building in San Francisco. The walls are of brick, but the foundation is of rubble from Angel island. Considerable granite is used in the basement and steps from the quarries at Rocklin and Penryn, near the American river, in Placer county. The window-sills, key-stones, and balustrade are of sandstone from San José, in Santa Barbara county; the corridor floors are marble from Vermont and Massachusetts, and black marble from Glens Falls, New York. The Penryn granite, from the quarry of Griffith & Griffith, was employed in the construction of the basement of the United States mint, water-table of new city hall, dry-dock at Mare island, the new Stock Exchange and the Real Estate Associates' buildings. The people are afraid of stone buildings on account of their being cracked by earthquakes, and most of the large business buildings are of iron. The foundations and underpinnings are of granite, rubble from the vicinity of the city and from Folsom and Penryn and Napa, and sandstone from San José. There are about 46 miles of streets paved with cobble-stones, basalt, and granite from Sonora and Penryn. A few of the sidewalks are paved with granite from Folsom, and Vermont slate. Curbs are of granite from the various quarries which supply the city with this material. There are 11,000 feet of sea-wall constructed of rubble from Telegraph hill. The San Francisco dry-dock is constructed of granite from Folsom. The terrace walls and basements of the buildings of Messrs. Stanford, Hopkins, and Cooks are built of basalt from Sonora. Penryn granite is largely used in brick and iron structures as steps, sills, stairways, and window-caps.

SARATOGA, NEW YORK.

The stones used in Saratoga are mostly blue limestone from rocks of Trenton age quarried near the town. Foundations are built of this stone. Ohio sandstone and Connecticut brownstone are used for trimmings in some of the large buildings. Brick has been employed in the construction of the large hotels and other public buildings. Most of the streets are macadamized with cobble-stone and broken limestone. Broadway has about three-quarters of a mile of cobble-stone pavement. The sidewalks are mainly laid with brick, excepting in the business part of the town, where the North River blue-stone and a little Vermont marble are laid on the curbs of the cross sidewalks with blue limestones from the vicinity.

SAVANNAH, GEORGIA.

The nearest stone quarry to the city of Savannah is located near Milledgeville, in this state, distant about 175 miles. The granite at that point is excellent, but being difficult to work on account of its hardness, no systematic effort to introduce it here has been made. Most of the granite is in use for steps and window- and door-sills, brought from Stone mountain, near Atlanta. The Presbyterian church is a large granite building, with a wooden steeple. The custom-house is built entirely of granite. These are known as stone buildings, and the materials in both case came from Quincy, Massachusetts. Cobble-stone for paving material comes as ballast from northern ports. Only the business streets are paved, and the materials used are the cobble-stone and Hudson River blue-stone from New York. A few of the sidewalks are paved with the Hudson River flags.

SCHENECTADY, NEW YORK.

Stone is rarely used in this county except for foundations, and there are not many opportunities of judging of the character of the material used in stone construction. In one or two instances, Saint George's church, for example, the stone from the local quarries when properly laid has proved to be of most excellent quality. It makes, when carefully laid in foundations, very regular faces, and preserves its rich color for an indefinite period; however, when improperly handled by the masons, as when set on edge, it is liable to exfoliate to such an extent that it becomes necessary to substitute new blocks of stone. It may be so handled as to form substantial and durable walls in stone structures. All the streets are paved with cobble-stones, from 4 to 6 inches in diameter, found on the surface of the ground in the vicinity. The sidewalks are paved with stone 5 feet wide and 2 inches thick, from the Helderberg formation.

SCRANTON, PENNSYLVANIA.

The Coal Measures are eroded from the mountain ridges on either side, leaving the Seral-Conglomerate Pocono sandstone and Catskill sandstone exposed on their sides and crests. These sandstones furnish most of the stone for ordinary purposes of construction in the city.

The amount of stone construction is but trifling; the most important building—the new court-house—is now in course of construction, and is located in what was once a deep swamp; the foundations are 30 feet in depth and constructed of the Seral-Conglomerate quarried at Shanty hill, in the vicinity of Scranton. The superstructure is to be of Catskill sandstone quarried in the mountain ridge just west of Scranton, and the heavy trimmings of Devonian limestone from near Syracuse, New York.

For bridge abutments the Catskill sandstone quarried in the mountains near Scranton is used; it is extremely hard, withstanding exposure, and is easily quarried in regular blocks suitable for the purpose. Only two streets are paved with stone, and the material used in these instances is cobble-stone from the stream. There is considerable stone sidewalk paving, and the material for the purpose is brought from Nicholson, Wyoming county, Pennsylvania; also some from Brandt, Susquehanna county; Lehigh slate is used to a limited extent for the same purpose. The curbstones are Catskill sandstone quarried in the vicinity.

SPRINGFIELD, MASSACHUSETTS.

Brick is largely used for the purposes of construction in Springfield, to the exclusion of stone. In addition to the number of stone buildings enumerated which are built of Longmeadow sandstone and Monson granite, those two materials are frequently employed for sills, cornices, and other trimmings. A few buildings have trimmings of Ohio sandstone; none of these materials show signs of decay, as the stone structures are all of recent date. The upper part of the city is built on terraces of stratified sand; the lower part has some foundations in clay, and in places piles are driven before laying foundations; these are thought to be in the old channel of the river on the lower terrace; some settling has been noticed under the spires of two churches, but this is attributed to faulty construction and not to the ground. The foundations and underpinnings are chiefly of Longmeadow sandstone. The streets are macadamized with trap from Westfield, and a few of the sidewalks are paved with Hudson River flags and granite flags from Monson. Curbstones are of Monson gneiss and Longmeadow sandstone.

SPRINGFIELD, OHIO.

Stone from the upper or Springfield division of the Niagara formation is quarried in the vicinity of this city, and is used for the less ornamental classes of construction. The stone from the quarries here is chiefly used in rough work, such as cellar walls, bridges, sewers, and the like. The Episcopal church edifice, on High street, Springfield, is built of this stone in the rough, and displays fine architectural effect. The Central high school was built of limestone from the local quarries. As very few buildings of this kind have been put up in this city, scarcely any judgment can be made of the Springfield stone; for other and rougher work it has stood the test of time for half a century or more. The site of the city is well adapted to buildings of weight; indeed but few feet in depth would place buildings upon solid strata of the Niagara limestone. The Portsmouth and the Berea sandstones have both been used to a limited extent for trimmings. But few of the streets are paved, and those are paved with cobble-stones and macadamized with the local limestone. Sidewalks are but little paved with stone, and the material used is the Springfield and Dayton limestones; also to a very limited extent the Berea and Portsmouth sandstones. For bridge abutments, sewers, and work of that class the limestone from the home quarries is employed. Whether it is set on edge or as in the natural bed seems to make less difference with this material than with most building stones.

STEUBENVILLE, OHIO.

Material for all stone construction in this place is quarried in the vicinity from the beds of sandstone in the Upper Coal Measures. The material is durable and comparatively pleasing in appearance, and is used for caps, sills, corners, and other trimmings. The Jefferson County court-house is the only building of importance in which stone from a distance is used; this structure is built of Amherst, Ohio, sandstone. Of the buildings enumerated as having stone fronts, none have fronts entirely of stone. The principal church and McGowan's block are built of sandstone from local quarries. Considerable of the cemetery work, such as monuments, bases, and inclosures, is made of sandstone from a local quarry. This material is susceptible of fine carving, though it is of rather coarse texture. The wharves in Steubenville are constructed of cobble-stones taken from the Ohio river at low water. The abutments of the Pan Handle Railroad bridge across the Ohio river at this point, and the water-works, are also constructed of the local sandstone. In such streets as are paved cobble-stones from the Ohio river are the material used. There is but little stone sidewalk pavement, and the material for this purpose is obtained from local quarries.

TAUNTON, MASSACHUSETTS.

In the vicinity of Taunton there are several small ledges which are worked occasionally for a short time when wall stones are needed for some particular building. The irregularity with which these openings are worked does not admit of their being enumerated with important quarries. Their product is a bluish "wall" or "mortar" stone, similar to a material quarried near Lowell, Massachusetts. Of the eight stone buildings in Taunton three are built of granite from Acushnet, and five of the "mortar" stone from the vicinity. The foundations and underpinnings are of the local mortar stone and Acushnet granite. The streets are but little paved with stone, the material used being cobble from the fields in the vicinity. A few of the sidewalks are paved with Acushnet granite, and curbs are of the same material.

TERRE HAUTE, INDIANA.

Stone is but little used in this city, but that employed comes from quarries that furnish the best building stone in the state—those of Bedford, Ellettsville, and Stinesville. There is no building constructed entirely of stone, and the number of stone fronts, chiefly of the materials above mentioned, is about 100. Brick is used for foundations because of its cheapness, the impression here being that a stone foundation costs as much as an entire building constructed of wood. Sandstone that may be found near is not suitable for use in construction.

TOLEDO, OHIO.

Toledo is so situated as to have ready access by water to noted quarry regions, such as Amherst and Berea, Kelley's island, point Marblehead, and other places in the vicinity of Sandusky. The stone for the rougher building purposes is the limestone from Sandusky, point Marblehead, and vicinity; that for the better class of construction is chiefly sandstone from Amherst and Berea. In one building constructed of the Sandusky limestone the wall has been broken by frost, to which it is said to have been subjected before the material was out of the quarry long enough to be thoroughly seasoned. Out of 140 miles of sidewalk there are 3.6 miles paved with stone; the total length of the streets is 271 miles; total length of pavements $44\frac{1}{2}$ miles, of which $7\frac{1}{2}$ miles are paved with Medina sandstone; 4 miles with small bowlders picked up from the surrounding country; 3 miles macadamized with sandstone; $3\frac{1}{2}$ miles paved with cedar blocks; and 27 miles are paved with plank. Some of the sandstone used in the outside walls of buildings has been set on edge, consequently the color resulting from weathering is not uniform.

TOPEKA, KANSAS.

The stone found in the vicinity of Topeka is an impure limestone suitable for foundations, underpinnings, and work of that class. The other materials used here to a limited extent are sandstone from Warrensburg, Missouri, and limestone from Cottonwood, Chase county, and from Junction City. This latter can be sawed with an ordinary tooth-saw, is full of chert concretions, and is subject to discoloration when exposed; it is not now used. The Cottonwood limestone is a good, strong, substantial material; it can be obtained in masses of from one to five cubic yards, and is now being used for the foundation of the main building of the state capitol.

Safford limestone is a very fine material, composed almost wholly of shells in an unbroken state, takes a good polish, and is quite durable; it is used for steps, trimmings, and curbing.

The Warrensburg sandstone is gray in color and is used for fronts, but in other places to a greater extent than here, and has given satisfaction. A red sandstone found in Colorado, near Pueblo, is used for trimmings; it forms a fine contrast with native limestone. The streets are not paved with stone; the sidewalks are paved with a flagging of a slate formation found in Osage county and sandstone flagging from near Fort Scott, Kansas. The college building, female seminary, and the state insane asylum are built of native stone (magnesian limestone of Permian age) found in the vicinity of Topeka. This material is not suitable for fine trimmings. The west wing of the state capitol was built of limestone from Cottonwood quarry; the United States post-office buildings, now in course of erection, are of the soft limestone found in Crowley county. The east wing of the state-house was built of limestone from Junction City, Davis county.

TRENTON, NEW JERSEY.

Among the stone buildings of Trenton the most prominent are: Of Ohio sandstone: The United States government building. Of Trenton sandstone: The state capitol, the state prison, Saint Mary's Roman Catholic cathedral, Warren Street Presbyterian church, State Street Presbyterian church, Prospect Street Presbyterian church, State Street Methodist Episcopal church, Clinton Avenue Baptist church, Bishop Scarborough's residence, James Moses' residence, John Moses' residence, Richie's private residence, the Pennsylvania Railroad depot. Of Connecticut brownstone: The front of Taylor hall.

Of the buildings enumerated, the United States government building is a new structure and presents a fine appearance. The brown sandstone or freestone of the Greensburg quarries, sometimes known as Trenton freestone, is very largely used for house trimmings, as sills, lintels, caps, and steps; also for table-tops, etc. Montgomery county, Pennsylvania, marble is also used to some extent for trimmings with Philadelphia and Trenton pressed brick, but the use of the freestone is increasing while that of the marble is diminishing. North River blue-stone is also used to some extent for the same purposes. Trenton is very largely built of brick, as Philadelphia and Trenton pressed or front brick are conveniently had, and at comparatively low rates, being less expensive than stone.

The Pennsylvania Railroad Company's bridge crossing the Delaware river has abutments and piers of Greensburg brownstone; the abutments and piers of the wagon bridge over the Delaware are also constructed of the same material, as are the locks, walls, and feeder of the Delaware and Raritan canal.

The majority of the streets are paved; and in such streets as are paved, stone from Lambertville, New Jersey, and some granite are used.

The following is a statement showing the extent of stone pavement in Trenton :

	Feet.
Belgian block.....	14,170
Cobble-stones	2,880
Telford macadamized	3,000

There is considerable sidewalk pavement on the principal streets, and the material used is blue-stone from the North River quarries, and stone from the quarries at Medford, Hunterdon county, New Jersey. North River blue-stone is used for curbs.

TROY, NEW YORK.

The materials used for stone construction in Troy, for foundations and underpinnings, are shale, quarried in the vicinity, and similar material quarried near Schenectady. For the better class of stone construction Connecticut brownstone from Portland, limestone from the Upper Aqueduct quarry and from near Niskayuna, are the principal materials. The bridge abutments are of shale and Upper Aqueduct limestone; some limestone is also brought from the Lower Aqueduct quarry, but it is not as durable as the Upper Aqueduct limestone. The streets are largely paved with granite blocks from Clarke's island, Maine, and from Weehawken, New Jersey. The sidewalks are largely paved with blue-stone, brought chiefly from Malden, New York; and mica-schist from western Massachusetts is used to some extent for the same purpose. Curbs are of blue-stone from Malden, New York.

UTICA, NEW YORK.

There is an abundance of good building stone within a short distance of Utica, and until recently the rates of transportation have made brick a cheaper building material. The sandstone of the immediate vicinity has been used most largely for foundations, but at present, for heavy buildings the limestone of the Trenton formation is used. The sandstone is not durable enough for heavy foundations; it was largely used in former years as stone for cross-walks and the like, but was found to flake under heavy traffic. There are no peculiarities of the ground that render it difficult to use stone for building purposes, but, owing to the comparative cheapness of brick and lumber, it has been considered expensive. There are within the limits of the city sixteen iron bridges over the Erie canal, the abutments of which are built of limestone from Little Falls, New York; also three bridges over the Chenango canal, the abutments of which are built of Cayuga sandstone. There is one block in the city faced with marble. The weigh-lock and house of the Erie canal is of Little Falls limestone. For foundations and underpinnings for the rougher purposes of stone construction sandstone from the local quarries is used; also, to a very limited extent, limestone from Canajoharie, New York. The streets are largely paved with stone, and the material used is cobblestone; also Medina sandstone, and stone from Hammond, New York. The sidewalks are largely paved with Cayuga sandstone and Hudson River blue-stone.

WATERBURY, CONNECTICUT.

The stone quarried in and about Waterbury is a coarse, hard, granitic rock, and is irregular in many respects as to color, hardness, and general appearance, though most of it is very hard, and there are places in some of the quarries where blocks, regular as to shape and uniform in texture, may be extracted. It is an excellent stone for foundations and for cellar walls, but, unless selected with great care, it is of little use for other purposes. The streets are not paved; about half a mile of the sidewalks is paved with North River blue-stone, with curbs of the same material.

WATERTOWN, NEW YORK.

Watertown lies on both sides of Black river, whose rapid currents have worn a channel through the limestone rock, composed of blue limestone, Birdseye and Trenton. Some of the fine churches and grist-mills and factories were built of limestone, but at present brick is used in the construction of such buildings, it being less expensive, although the limestone is easily worked and very durable.

The limestone rock is very much grooved and striated in places by the passage of glaciers, especially where they cross the Black river. The Lorain shale, so-called by geologists, is native in the town of Lorain; the rocks of the county present an interesting field for geologists. There are exposures here of the Upper and the Lower Silurian rocks. The limestone rock of the Black River valley is studded with fossils of animal life that existed only in the sea; cephalopods are bedded in the blue limestone, which is comparatively pure carbonate of lime, but is very brittle; otherwise it is durable and susceptible of a fine polish. There is in this vicinity what is called Scotch granite, and also a marble known as Carrara marble. They are probably so called from their resemblance to the Aberdeen Scotch granite, and to the rare Carrara Italian marble, respectively. These were lately discovered in large quantities, which lay in perpendicular strata. Talc is found in large quantities and is being manufactured; it lies generally between Archaean rocks, and often unconformable to those which are in regular strata, and make beautiful flagging stones for sidewalks.

WASHINGTON, DISTRICT OF COLUMBIA.

The formations in the vicinity of Washington are made up chiefly of sand, gravel, and clay, with some isolated bowlders detached from the primitive rocks lying to the north and west. North of Rock creek the rocks of Archæan age are exposed, and ledges of mica-schist of this age have been quarried in and about Georgetown since the first settlements were made. It has been employed chiefly for the ruder purposes of construction, such as foundations, terrace walls, rubble pavements, and work of that class. The most important structure built of it is the new Georgetown College building. It was employed in the foundations of the Executive mansion, the Treasury building, and in those of most of the other public buildings in which the Acquia Creek sandstone was used for superstructure. A chapel in Oak Hill cemetery, built after the style of the time of Henry VIII, is of this material, trimmed with Seneca sandstone.

Mr. George P. Merrill, of the Smithsonian Institution, made careful field observations and examined specimens and microscopic sections of the different varieties of this rock, and reported as follows:

The rock quarried in the vicinity of Washington, and of which the walls of Georgetown college and various other public buildings are composed, is a compact mica-schist of a structure and texture varying from coarsely schistose, splitting easily into thin sheets, and a fine-grained massive rock in which the individual ingredients are so evenly commingled that all traces of stratification are lost. The essential constituents are quartz and mica, the latter being biotite of a deep green color.

Under the microscope numerous accessories are found to be present, among which are epidote, apatite, garnet, magnetite, and rutile, the first-named being the most abundant, while the rutile occurs only as small ocular crystals penetrating the quartz granules. A plagioclasic feldspar is occasionally met with, and in this case the rock approaches gneiss in constitution. The chief objection to the use of this rock for architectural purposes lies in the fact that it frequently contains a large amount of pyrite or iron disulphide. On being exposed to the air this pyrite becomes oxidized, and the rock disintegrates, or at best is badly stained or discolored. It is this same ingredient that renders many of our sand and lime stones unfit for use, they becoming streaked and spotted with unsightly spots of a rusty red color after being exposed a short time to atmospheric agencies.

In conclusion, I would say that there seems no reason why this rock should not be utilized for building purposes, provided sufficient care be exercised in selecting only such portions as are entirely free from this deleterious substance.

On the Potomac river, 40 miles below the city, at Acquia creek, there is a ledge of light gray and rather coarse sandstone, and quarries of the material were purchased by the United States government in 1791 for the purpose of using it in the construction of the public buildings; the Executive mansion and other older buildings are of Acquia Creek sandstone.

The Executive mansion, or "White House", was commenced in 1792. On September 19, 1793, the cornerstone of the Capitol building was laid by Washington himself, and the central or older portion is constructed entirely of Acquia Creek sandstone from the government quarries. This material was used in the construction of all the important public buildings that were commenced up to 1837. The list includes the Executive mansion, the central or old part of the Capitol building, the old portion of the Treasury building, the old portion of the Patent Office building, and the foundation of the city hall. The Van Ness residence, at the foot of Seventeenth street, was also built of it in 1802.

About 20 miles north of the district, on the Potomac river, the southern edge of the Triassic, or new red sandstone, formation crosses the river, and at this point furnishes the material called "Seneca sandstone", the equivalent of the Connecticut brownstone.

The stone at the mouth of Seneca creek was used in the construction of the Smithsonian Institution building; the *National Republican* building, now used as the Pension Office; the District jail; the front of the Freedman's Bank building, now occupied by the Department of Justice; Lincoln hall; portions of the terraces about the Capitol, Treasury, and other public buildings; the United States prison; the Memorial Lutheran church; and in the trimmings of the chapel in Oak Hill cemetery. When the Chesapeake and Ohio canal was built, in the early part of this century, the Seneca sandstone was much used for locks and dams, especially in that portion of the canal lying near these quarries. In these various situations it has shown remarkable wear and endurance of exposure. This canal constitutes a convenient and inexpensive method of transportation from the Seneca quarries to Washington.

The three materials described, the Potomac mica-schist, the Acquia Creek sandstone, and the Seneca sandstone, from their close proximity to Washington and accessibility by water, may be said to constitute the local supply of building stone.

Washington has access by water to all the important quarry regions of the Atlantic coast, and of late years building stones from the localities named below have been used more or less extensively: Granite from the coast of Maine; from Cape Ann, Massachusetts; Westerly, Rhode Island; Woodstock, Maryland; and from near Richmond, Virginia. Marbles from Rutland and Sutherland Falls, Vermont; Montgomery county, Pennsylvania; Tuckahoe, Westchester county, New York; Lee, Massachusetts. Hudson River blue-stone from Ulster county and vicinity, in New York. Brownstone from Portland and other places in the Connecticut valley; from Belleville and New Brunswick, New Jersey; Hummelstown, Pennsylvania, and Manassas, Virginia. Slate from Vermont, New York, Pennsylvania, and Buckingham county, Virginia. Gneiss from Port Deposit, Maryland, and sandstone from Nova Scotia.

The materials from distant points began to be introduced about 1840, as at that time the stone from the government quarries at Acquia creek which had been used in the construction of so many important public and

private buildings was found to be so inferior in point of durability and general appearance that the quarries were abandoned and other sources were looked to. An examination of the buildings constructed of the Acquia Creek sandstone shows that numerous clay-holes have appeared, caused by the disintegration of portions of the rock from exposure to the atmosphere. Experience with this stone has proved that within a few years, unless constant attention is given to it by filling the clay-holes and covering with a coat of paint, the stone becomes flimsy and unrepresentable. All the public buildings in which it was used are painted, both for the sake of preservation and to make them harmonize with the white marbles and light-colored granites that have been used in the construction of additions and extensions, as the exigencies of the public service required the buildings to be enlarged. The two wings of the Capitol are built of Lee (Massachusetts) marble, excepting the columns, which are of Cockeysville (Maryland) marble. The style of architecture is Corinthian.

There is quite a variety of stones used in the interior decoration of the Capitol. The eastern stairway leading to the galleries of the Senate Chamber, the eastern and western stairways leading to the galleries of the Hall of Representatives, and the walls of the Senate reception-room (Marble room) are of polished Tennessee marble. There are Ionic columns of breccia or variegated Potomac marble in the apartment of the Supreme Court of the United States; the National Statuary hall, formerly used as the Hall of Representatives, has a circular colonnade of shafts of this material surmounted by capitals of Carrara marble executed in Italy. This stone, when highly polished, presents to the eye an apparently rough and broken surface, which delusion is only dispelled by touching it.

The western stairway to the gallery of the Senate Chamber is of Italian marble, and the statuary in and about the Capitol is chiefly of Carrara and Serivezzia Italian marbles.

Greenough's colossal statue of Washington, in the east park, weighs 12 tons, and was executed in Florence, Italy. The stones used in the terraces, walks, and inclosure-walls about the Capitol are of Seneca sandstone, Lake Champlain marble, North River blue-stone, Rock Creek mica-schist, granite from Maine, Massachusetts, Richmond, Virginia, and other places, and the sub-Carboniferous sandstone from northern Ohio.

The old portion of the Treasury building, commenced in 1836, was constructed of the Acquia Creek sandstone, with foundations of Potomac mica-schist. The extensions made to the northeast and west sides of the building were begun in 1855. The material used in the extension is Dix Island, Maine, biotite granite, with foundations of Port Deposit gneiss. The style of the building is Grecian-Ionic. The granite shafts of the colonnades are monoliths. Opposite the north front is an ornate fountain of circular shape, 12 feet in diameter, cut from a solid block of granite. The following materials were used in the walls of the lower story: Stylobate; base, Isle La Motte, Vermont, marble (magnesian limestone); moldings, Bardiglio veined marble from Serivezzia, Italy; styles, dove-colored marble (magnesian limestone) from Pittsford, Vermont; panels, yellow sienna Italian marble; dies, Hawkins County, Tennessee, marble (limestone); above stylobate, pilasters and panels, white-veined Italian marble; styles, yellow sienna Italian marble; panels, Bardiglio veined marble from Serivezzia; cornice, white-veined Italian marble; upper story, stylobate, same as lower; above stylobate, as in lower story, except the panels, which are Pyrennean breccia.

THE STATE, WAR, AND NAVY BUILDING.—The stone used in the superstructure is a light gray biotite granite, quarried near Richmond, Virginia; the basement being of Vinal Haven, Maine, granite. The interior walls of the basement of the southeast wing are built of Seneca sandstone. The tiling of the corridors and passages is of white and black Vermont marble and Lehigh, Pennsylvania, slate. The tiling in nearly all the public buildings in Washington is of the same materials.

There is an example of marble interior decoration in the library of that portion of the building assigned to the Navy Department; the walls of the library are of the following materials: Alps green or verde-antique, a kind of serpentine, yellow sienna Italian marble, French griotte marble, and Lake Champlain red mottled marble.

THE GENERAL POST-OFFICE.—The post-office is of Corinthian style of architecture. The E-street portion, constructed in 1839, of West Chester, New York, snowflake marble (dolomite), was the first important structure in Washington built of marble. In 1855 an extension to the north of the building was commenced, and the material used was marble from Cockeysville, Maryland, with portions of the foundations and facing of the court of granite. The columns of the extension are marble monoliths.

THE PATENT OFFICE BUILDING.—This is considered quite a good specimen of Grecian-Doric style of architecture, and covers $2\frac{3}{4}$ acres of ground. The original building, commenced in 1837, is of Acquia Creek sandstone. In 1849 the extension, built of Cockeysville, Maryland, marble, was begun. This extension was added to the northeast and west sides in such a way as to inclose a quadrangle, the walls of which, and the sub-basement of the whole edifice, are built of Maine, Quincy, Massachusetts, and Woodstock, Maryland, granite.

THE SMITHSONIAN INSTITUTION.—The Smithsonian building is constructed of the Seneca sandstone. An examination of the building at the present writing shows it to be firm and substantial, and practically unaffected by any agencies, whether atmospheric or otherwise, except that Mr. Owen described the color of the stone when first quarried as a lilac gray, whereas it is now of a deeper and darker red color, due to its nature. In occasional nooks and corners in shaded portions of the building moss has appeared on the surface. It should be stated, however, that stone which is to be used for building purposes should be carefully selected. The top courses and

others manifestly inferior should be rejected. A little observation reveals that many building stones, especially sandstones, acquire an unfavorable reputation by lack of care in not rejecting the unfit portions, as in nearly all quarries there are layers close to the surface, and sometimes in deeper portions, which are defective and unfit for use.

The building is in style of architecture Norman, dating about the end of the twelfth century, and ranks as one of the best specimens of this style now in existence. The different portions of the edifice, examined separately, are unlike in appearance, yet the general effect is pleasing and harmonious.

THE WASHINGTON MONUMENT.—According to the original design of the Washington monument, an obelisk 600 feet in height and 55 feet square at the base was contemplated. The original foundation was 80 feet square and 16 feet 8 inches in height, 7 feet 8 inches extending below the surface. The wall of the obelisk is 15 feet in thickness at the base, gradually tapering at the rate of a quarter of an inch to the foot on the outside, the inside being perpendicular. The work is now rapidly progressing according to the original design, except that it is proposed to limit the height to 525 feet. The old foundation was pronounced defective by a board of engineers, and was enlarged to 126 feet 6 inches square, a work which was completed in 1880, and was done by excavating 70 per cent. of the earth from beneath the monument and introducing a mass of concrete 13 feet 8 inches in thickness. The great height of this structure, together with the marshy nature of the ground in its vicinity, made it necessary to use more than ordinary precautions in constructing a foundation that could be considered secure. The exterior walls of the shaft are of marble from Cockeysville and Texas, Baltimore county, Maryland, though in the beginning some Lee, Massachusetts, marble was used. The interior walls are chiefly of granite from different places on the coast of Maine. In a report made by Colonel Thomas L. Casey, corps of engineers, United States army, engineer in charge of the construction of the monument, to W. W. Coreoran, esq., chairman of the joint commission for the completion of this structure, dated July 27, 1878, is found the following table. So extraordinary a test of stability is given to the stone by the great weight of the superstructure, that it will be watched closely by builders and engineers as time determines its endurance :

Distance of joint from top in feet.	Contents in cubic feet.	Average weight per cubic foot of masonry in several divisions.	Weight in pounds.	Pressure in tons (2,240 pounds) per square foot.			Distance of "line of resistance" from axis in feet.	Stability under action of the wind.
				Least.	Mean.	Greatest.		
25							0.603	29.454
50	18,555	First division.....169.5 pounds.	2,297,690	2.87	2.96	3.26	1.052	17.378
100	34,719		5,884,078	4.41	5.23	6.04	1.676	11.529
150	63,957		10,840,728	5.85	7.24	8.04	2.087	9.758
171.66	79,239		13,431,081	6.44	8.08	9.72	2.224	9.360
200	101,674	Second division.....107.8 pounds.	17,195,718	7.14	9.12	11.09	2.383	8.983
250	148,268		25,019,140	8.35	10.90	13.44	2.607	8.610
300	204,273		34,411,997	9.54	12.63	15.73	2.779	8.452
343.66	261,101		43,963,655	10.56	14.11	17.66	2.899	8.417
350	272,309	Third division.....105.8 pounds.	45,816,912	8.28	11.51	14.73	2.892	8.481
400	306,268		61,385,397	10.09	13.84	17.00	2.869	8.902
450	470,495		78,666,278	11.76	16.03	20.30	2.889	9.190
500	585,470		97,264,244	13.38	18.02	22.658	2.928	9.413

The mean pressure per square foot upon the lower joint is 18.02 tons, and the maximum pressure brought upon any square foot of the lowest joint under the action of the wind is 22.658 tons. The crushing weight of the marble, as determined by the board above mentioned, is 517 tons per square foot.

Nearly 200 memorial blocks were sent by the different states of the Union, by corporations, lodges, societies, individuals, and foreign countries, to decorate the interior walls of the monument. Blocks of granite came from the various regions of New England, Virginia, Maryland, California, Minnesota; marble and limestone from Vermont, Massachusetts, New York, Pennsylvania, Maryland, Virginia, North Carolina, Ohio, Kansas, Missouri, Iowa, Illinois, Mississippi, and Canada; and sandstone from the Triassic brownstone quarries of Connecticut and New Jersey. The following are some of the stones received from foreign countries: A block from the tomb of Napoleon, island of St. Helena; block of Grecian marble from the temple of Esculapius, presented by the officers of the United States steam frigate Saranac; block from Foo-chow, China; lava from Mount Vesuvius; sandstone said to be from the original chapel built to William Tell in 1358, on lake Luzerne, Switzerland; red syenite (granite) from the empire of Brazil; Grecian marble from the governor and commune of the islands of Paros and Naxos, Grecian archipelago; marble from the Ottoman empire; a block of peculiar and characteristic greenish stone from China: a highly-polished block of red granite from Bremen; Grecian marble from the kingdom of Greece; a head carved between two and three thousand years ago by ancient Egyptians for a temple erected in honor of Augustus, on the banks of the Nile, and set in a block of Italian marble.

Some of the contributions from corporations, societies, and individuals in this country are of Italian marble.

In the following list will be found some of the principal stone structures in Washington and vicinity, with kinds of stone used in their construction:

1. ACQUIA CREEK SANDSTONE.

Executive Mansion.
Capitol building (old portion).
Van Ness residence.
City Hall foundation.
Treasury building (old portion).
Patent Office building (old portion).
Van Ness mausoleum.

2. POTOMAC MICASCHIST.

Foundation of Executive Mansion.
Foundation of Treasury building.
Foundation of Washington Monument.
Chapel in Oak Hill cemetery.
Georgetown College (new building).

3. SENECA SANDSTONE.

Smithsonian Institution.
Chapel at Soldiers' Home.
Chapel in Oak Hill cemetery (trimmings, front).
Department of Justice, formerly Freedman's Bank.
District jail.
National Republican office, now Pension Office.
School-house, Second and Potomac streets.
Lincoln Hall.
Cabin John's bridge, parapets and coping.
Memorial Lutheran church.
Sub-basement south wing State, War, and Navy Department building.
Center Market (foundations).

4. WESTCHESTER COUNTY, NEW YORK, MARBLE.

E-street portion of the General Post Office building.

5. COCKEYSVILLE, MARYLAND, MARBLE.

Exterior walls of Washington Monument.
Columns of the Capitol extension.
Extension of Patent Office building.
General Post-Office building (extension).
Ascension church.
Dormitory at Soldiers' Home.

6. LEE, MASSACHUSETTS, MARBLE.

Portion of the exterior walls of the Washington Monument.
Capitol extension.

7. MAINE GRANITE.

Interior of Washington Monument.
Extension of Treasury building.
Basement of new State Department building.
Quadrangle of Patent Office building.

8. QUINCY, MASSACHUSETTS, GRANITE.

Patent Office interior walls, foundations, and basement (partly).

9. WOODSTOCK GRANITE.

Foundation of the Patent Office building (partly).
National Museum (foundation).
Masonic Temple (foundation).

10. PORT DEPOSIT GNEISS.

Foundation of Treasury building (extension).
Saint Dominick's church.

11. BELLEVILLE, NEW JERSEY, BROWNSTONE.

Corcoran Art Gallery.

12. MANASSAS, VIRGINIA, BROWNSTONE.

District jail (trimmings).

13. MONTGOMERY COUNTY, PENNSYLVANIA, MARBLE.

Stone-work at Botanical Garden.
Sarcophagi containing bodies of George and Martha Washington, at Mount Vernon.

14. CAPE ANN GRANITE.

Residence of Benjamin F. Butler.

15. CONNECTICUT BROWNSTONE.

Foundation and trimmings of E-street Baptist church.
Saint Marc hotel.
Arlington hotel (front).
Columbia Institution for the Deaf and Dumb (trimmings).
Masonic Temple (partly).
Residence of Senator William Windom.
Residence of Lieutenant Broadhead (trimmings).
Metropolitan church.
Agricultural building (trimmings).
First Presbyterian church.

16. NOVA SCOTIA SANDSTONE.

Masonic Temple (trimmings).
Colonization building (front).
Riggs house.

17. RICHMOND, VIRGINIA, GRANITE.

State, War, and Navy building (superstructure).
Bureau of Engraving and Printing (foundation).

18. OHIO SANDSTONE.

National Republican building, now Pension Office (trimmings).
Baltimore and Ohio depot (trimmings).
Lewis Johnson & Co.'s bank.
British Legation building.
National Museum building.
Ex-Governor A. R. Shepherd's block, opposite Farragut statue (Buena Vista stone).
Portland flats.
Capitol grounds, inclosure-walls (partly).
Columbia Institution for the Deaf and Dumb (trimmings, partly).

19. HUMMELSTOWN BROWNSTONE.

Residence of Hon. James G. Blaine (trimmings).
Residence of Senator John Sherman (trimmings).
Residence of Senator J. D. Cameron (trimmings).
Residence of Jerome Bonaparte (trimmings).
Bureau of Engraving and Printing (trimmings).

20. CHESTER COUNTY SERPENTINE.

Residence on Fourteenth street.
Residence on Iowa circle.

21. VERMONT MARBLE.

Floors of National Museum building (Swanton Lyonnaise marble).
Walls of Library of Navy Department (partly).
Walls of cash-room in Treasury Department (partly).
Corcoran mausoleum, Oak Hill cemetery.

22. CHEAT RIVER, WEST VIRGINIA, SANDSTONE.

Catholic institution between Twelfth and Thirteenth streets.

STONE PAVEMENTS.—In the report for the year ending June 30, 1880, Lieutenant F. V. Green, United States engineer corps, assistant to the engineer commissioner of the District of Columbia, gives the following interesting facts concerning the condition of the streets of Washington on the 1st of July, 1880:

	Square yards.	Miles.
Asphalt and concrete (coal tar).....	981,348	40.66
Stone block.....	411,774	14.87
Rough stone.....	559,051	18.04
Macadam.....	215,330	7.45
Gravel.....	644,903	31.31
Wood.....	509,481	22.10
Unimproved.....	1,799,541	95.62
Total.....	5,121,618	280.05

It is stated that there were in all 1,188,597.47 square yards of wooden pavements, aggregating a length of nearly 50 miles, and costing \$4,003,744; that in 1878 there were, exclusive of paving between railway tracks, 790,000 square yards, or 34 miles, of wooden pavements; and that on June 30, 1882, these pavements had been partially replaced to the following extent:

Years.	WITH ASPHALT.		WITH GRANITE.		WITH ASPHALT BLOCK.		TOTAL.	
	Square yards.	Cost.	Square yards.	Cost.	Square yards.	Cost.	Square yards.	Cost.
1878-1879.....	104,022.52	\$200,900 18	56,993.24	\$129,657 32	1,003.35	\$2,661 61	162,109.11	\$333,219 11
1879-1880.....	67,962.91	104,143 17	45,084.28	87,800 42	3,214.08	6,349 51	116,261.27	197,833 16
Total.....	171,985.43	305,043 35	102,077.52	217,047 74	4,307.43	9,011 12	278,370.38	531,102 21

The proportion of stone to asphalt laid in two years, from July, 1878, to July, 1880, is as 10 to 17.

The granite-block pavement here is laid on a foundation of gravel and sand, and the joints are filled with cement of coal tar and gravel, as before stated. Of the 18 miles of stone-block pavements 7 miles are composed of North River blue-stone and the balance of granite. The granite comes from various quarries in Maine and Cape Ann, Massachusetts, from Westerly, Rhode Island, and from Richmond, Virginia. The texture of the different varieties is quite dissimilar; the finer-grained stones make a smoother surface for a pavement and the coarser ones a more durable surface. Of the 17.50 miles of rough stone pavements 8 miles are composed of cobble (quartz or sandstone drift) and the remainder of rubble, mostly the so-called blue-rock or mica-schist, of Rock creek. A small amount of rubble is of the Seneca stone, which, owing to its more ready attrition, does not prove to be well adapted to paving purposes, excepting for sidewalks.

The macadam pavement is mainly of the mica-schist from Rock creek, but part of it is broken cobble-stone and a part of it flint-stone—that is, quartz found in seamy ledges in the mica-schist formation.

WHEELING, WEST VIRGINIA.

The site of Wheeling is very narrow, on account of the abrupt hills, situated a short distance back from the river, which oblige the city to extend itself to a great length along the stream, as the hills are too abrupt to furnish sites for buildings. The material used in stone construction is the Coal-Measure sandstone quarried in the immediate vicinity, and on the opposite side of the river, in Belmont county, Ohio. This is of sufficiently good quality to answer for all ordinary purposes of construction. For the soldiers' monument in course of construction the material used is granite obtained from the New England Granite Works at Hartford, Connecticut. Strictly speaking, there are no stone fronts in the city, but there is considerable stone in basement stories, corners, and other trimmings. The abutments of the suspension bridge across the Ohio river at Wheeling are constructed of sandstone from the local quarries. The wharves are constructed of cobble-stones gathered from the river at low water, and the streets are nearly all paved with this material. There is a small amount of stone sidewalk paving, and the material used is sandstone from the local quarries and from Buena Vista, Ohio; the Buena Vista stone comes already sawed to the proper dimensions for paving purposes; it stands foot-wear well. The local stone, from its coarser and more granular and friable structure, wears away more rapidly under foot-wear.

WILKESBARRE, PENNSYLVANIA.

Wilkesbarre is located in the celebrated Wyoming valley, which lies between two ranges of the Allegheny mountains, the sandstone of Catskill age being abundantly exposed on their sides and much used in Wilkesbarre for purposes of construction. This material is very durable, but hard and expensive to dress for fine work. One

of the principal quarries of this stone is situated in the mountains 7 or 8 miles east of Wilkesbarre; for the better class of trimmings Wyoming blue-stone from Meshoppen is now used almost exclusively; though considerable Catskill red sandstone is also employed for caps, sills, and trimmings generally. The Luzerne prison in Wilkesbarre is the most important stone structure of the place. It is built of Campbell's ledge stone, a siliceous conglomerate of a rich buff color, very substantial and durable. Several fine private residences in Wilkesbarre are constructed of it. There are some buildings trimmed with limestone from near Syracuse, New York. The material chiefly used for foundations and underpinnings is the Catskill red sandstone from the mountains in the vicinity. The Seral-Conglomerate, also quarried near, is used to a less extent for the same purpose. Only two or three streets are paved with stone, and the material used is cobble-stone from the Susquehanna river. The sidewalks are largely paved with stone, the material being the Catskill red sandstone before mentioned, and considerable Wyoming blue-stone from Meshoppen. Lehigh slate is also used to a limited extent for the same purpose. The curbstones are of Catskill red sandstone and Wyoming blue-stone. The bridge abutments in the bridges crossing the Susquehanna river are of Catskill red sandstone.

WILLIAMSPORT, PENNSYLVANIA.

There is no good stone for the better class of construction quarried near Williamsport, and where stone caps, sills, etc., are wanted they are brought from Hummelstown, Pennsylvania, almost exclusively, although some Berea and Amherst stone have been used for trimmings in one building. The Lycoming County court-house is trimmed with Nova Scotia sandstone, which nearly resembles the Ohio sandstone in color and texture. A few buildings have steps of the Montgomery County marble; the steps of the court-house are of New England granite, and are becoming slippery from foot-wear. In the cases of the North River blue-stone, Wyoming blue-stone, Ohio stone, and others having a sandy grit, there is no tendency to become slippery. The siliceous conglomerate, probably of Seral or Pottsville Conglomerate age, quarried at Ralston, Lycoming county, is the stone most used for steps and base courses; it is quite durable, does not become slippery, and seems to give entire satisfaction. It resembles the conglomerate at Pottsville quite closely. The stone most used for curbing is an even-bedded, slaty stone, easily quarried in suitable shapes for curbing; one piece being observed which was 30 feet long and one foot square at the end, resembling a hewn log. For bridge abutments rough stone from the mountains in the vicinity is used. Stone has heretofore been comparatively little employed at this place. Only one street is paved with stone and the material is rubble from the vicinity. There is but a limited amount of stone sidewalk pavement; the material most used is Wyoming blue-stone from near Meshoppen. Red and light-colored flags quarried in the vicinity are also used for this purpose, and there are a few flags of Ohio sandstone.

WILMINGTON, DELAWARE.

The building stones used in Wilmington are the Connecticut, Ohio, and New Jersey sandstones; marble from Cockeysville and Texas, Maryland; serpentine from Chester county, Pennsylvania; and granites from Brandywine creek, near the city. This last is the most convenient source of supply for the city for ordinary purposes, such as foundations and underpinnings, and for stone street pavements. The sidewalks are not paved with stone; the curbs are granite from Brandywine creek. The Cockeysville marble and the serpentine from Chester county are, however, in easy distance from the city, and have been used extensively. The court-house and a large church are constructed of the serpentine before mentioned, and also a building of Connecticut sandstone. The material in the walls of this building was set on edge, and it exfoliated badly. The following buildings are constructed of the Brandywine stone: Saint John's Protestant Episcopal church, Market street, and the houses of William Brinckly, Kennet street; Edward McIngalls, Eleventh and Jefferson streets; Joab Jackson, Eleventh and Washington streets; William Bush, Browne street; and Edward Tatnall, Market street.

WINONA, MINNESOTA.

Taking into consideration the location and readiness of access to the quarries and the quality of the material, there is no possibility of obtaining a better supply of building stone for use here than material found at Winona, Red Wing, and Stillwater. The stone when freshly quarried is easily wrought, but becomes hard by weathering. The railroad bridge, the jail, the sheriff's residence, and the piers and abutments of Winona bridge across the Mississippi river, are built of Winona limestone. Most of the business blocks are of red brick made near Winona. Some Ohio sandstone has been lately imported for trimmings. Among the other stones used for trimmings are the sandstone from Fond du Lac, Wisconsin, and the lime-rock from Frontenac and Kasota. The streets are not paved with stone, and there is but very little stone sidewalk pavement; the material used for this purpose is lime-rock from Winona.

WOONSOCKET, RHODE ISLAND.

In this place stone is very little employed as a material of construction. The quartzite and mica-schist, especially from the local quarries, have been largely used in building the mills, many of which are stuccoed. Northbridge, Massachusetts, granite and Diamond Hill granite are considerably used for underpinnings in the

better houses. Curbs and crossings are usually of the Northbridge granite; walls are built largely of the local quartzite, which forms the poor man's stone of Woonsocket. The cobble-stones used in some of the buildings are found in the vicinity; in one or two structures Connecticut brown sandstone is employed.

WORCESTER, MASSACHUSETTS.

The houses here are mostly brick and frame structures. The main street contains most of the stone buildings. The local quarry known as Millstone ledge was some time ago given by its owner to the citizens for their free use; it is, however, mostly quarried by one man. The stone is good for common uses, but is not quite uniform in texture, and is too much stained for finer buildings or trimmings. The Arnold row of stores, built of this stone, exhibits its durability, and at the same time its rather unattractive appearance. The firm, sandy clay which forms the site of the city furnishes good foundations. The proportion of houses to inhabitants is large on account of the many small frame structures designed for the accommodation of factory employes. The foundations and underpinnings are of local gneissoid granites from the Millstone ledge. The principal business streets are paved with granite from Fitzwilliam, New Hampshire, and Westford, and the streets and sidewalks are usually paved with local and Fitzwilliam granites. The curbs are of the gneiss from the Millstone ledge. There are nearly 2 miles of stone arch sewers and bridge abutments built of the material from the local quarry. The Fitzwilliam granite is largely brought here by the proprietor of a local quarry. The Messrs. Norcross have constructed fine residences of the Longmeadow sandstone.

YONKERS, NEW YORK.

The stones in the vicinity of Yonkers available for building purposes are the trap boulders and a very rough gneiss-rock, good only for foundations. For the better class of stone construction brownstone from Portland, Connecticut, and Ohio sandstone are used. There is an aqueduct some 300 feet long and 40 feet high faced with partly rough and partly dressed stone, the rough material of which is broken boulders of trap, and the cut stone is gneiss from a local quarry. There is also about the town a great deal of retaining-wall made almost entirely of broken boulders of trap. All these boulders, of which there seems to be an unlimited supply, are found on or near the surface of the ground, enough being usually found in digging the cellar to build the foundation walls, and often underpinning also. The streets are to some extent macadamized with limestone from Tomkins Cove and with trap-rock and crushed boulders. This style of paving is known as the Telford paving; in some localities the sidewalks are largely paved with North River blue-stone, as are all the cities which are within easy reach of the blue-stone region. Curbstones are also of this material.

YORK, PENNSYLVANIA.

The Siluro-Cambrian limestone, quarried in the vicinity of York, furnishes all the material that is used for the construction of cellars, foundations, street paving, and road macadamizing. The Goldsboro' brownstone from the Triassic formation in York county is used to a considerable extent. Of the marbles used for caps, sills, curbing, etc., considerable comes from Cockeysville and the town of Texas, near Baltimore, Maryland, some from Montgomery county, Pennsylvania, and some from Vermont and Massachusetts. The Gettysburg granite, a trap-rock precisely similar to the Conewago granite, is much used in York for steps, bases, caps, and sills. It is quarried on the battle-field at Gettysburg. The limestone quarried in the vicinity is the only stone used near York in the construction of bridges. There is a canal wall constructed of it. For steps and curbing, beside the Goldsboro' brownstone, which is principally used, considerable Gettysburg granite is used; also some Richmond, Virginia, granite; marble from Cockeysville, near Baltimore; some Montgomery County marble, and, occasionally, Connecticut brownstone. For base courses Gettysburg granite is used to some extent; for caps, sills, etc., Cockeysville marble, Montgomery County marble, New England marble, and some Gettysburg granite. For hall-ways and office floors, black and white marble tiling prepared in Philadelphia is used. One building is trimmed with the Amherst, Ohio, stone. The streets are nearly all macadamized with the native limestone. Sidewalks are but little paved with stone, and the material chiefly used is the native limestone. Peach Bottom slate, however, is used for this purpose in a few instances. The curbstones are of Goldsboro' brownstone.

ZANESVILLE, OHIO.

The sources for building stone are a ledge of Coal-Measures sandstone, quarried in the immediate vicinity. This ledge is a solid mass, about 40 feet in thickness, so that the supply is abundant; by far the larger part of the stone in and about Zanesville is of this material. It is used exclusively in the construction of canal locks, house foundations, excepting occasionally the top courses, and it furnishes a considerable part of sidewalk pavement. Two or three of the oldest buildings in Zanesville are constructed entirely of this stone. It proves to be durable in the walls of buildings, but does not resist foot-wear so well. The stone work of the Clarendon hotel is of the local sandstone. An abundance of this material, the ease with which it may be worked, and its fair quality for all ordinary building purposes, give it the first place in importance among the building stones found in the neighborhood. Another source of supply is the ferriferous limestone near the same horizon.